ANALYSIS OF CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- MERITAGE KCM #6-32 BROYLES (SW SE 6-T.23S.-R.22E.), LINN COUNTY, KANSAS

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SUMMARY

Nine cuttings samples from the Pennsylvanian Cherokee Group were collected from the Meritage KCM #6-32 Broyles well in SW SE 6-T.23S.-R.22E. well in Linn County, KS:

- Mulky coal at 484' to 487' depth
- Flemming coal at 606' to 607' depth
- Tebo coal at 647' to 649' depth
- Rowe coal at 798' to 800' depth
- shale at 820' depth, 18' above Riverton coal
- Riverton "A" coal at 838' to 843' depth
- Riverton "B" coal at 864' to 868' depth
- Riverton "C" coal at 874' to 875' depth
- Riverton "D" coal at 876' to 877' depth

Assuming the dark shale that is usually admixed with the coal cuttings has approximately 3 scf/ton gas content, the coals calculate as having the following gas contents:

- Mulky coal at 484' to 487' depth (38.4 scf/ton)
- Flemming coal at 606' to 607' depth (34.5 scf/ton)
- Tebo coal at 647' to 649' depth (25.7 scf/ton)
- Rowe coal at 798' to 800' depth (64.3 scf/ton)
- shale at 820' depth, 18' above Riverton coal (3.2 scf/ton)
- Riverton "A" coal at 838' to 843' depth (55.2 scf/ton)
- Riverton "B" coal at 864' to 868' depth (32.1 scf/ton)
- Riverton "C" coal at 874' to 875' depth (47.2 scf/ton)
- Riverton "D" coal at 876' to 877' depth (82.6 scf/ton)

The Mulky and Tebo coals have high-gamma ray shales directly above them. The higher gamma ray reading commonly indicates higher organic content, which in turn likely increases gas content. Although the gas content of these high-gamma-ray shales may be greater than 3 scf/ton, present data indicate that the associated shales probably have less than 10 scf/ton gas content. Commensurately though, these coals may have less gas content than indicated above.

The most reliable results, which is largely controlled by the amount of coal in the cuttings, are from the Riverton "C", Rowe, Flemming, and Riverton "D" samples. The least constrained results are from the Mulky coal sample.

BACKGROUND

The Meritage KCM #6-32 Broyles well in SW SE 6-T.23S.-R.22E. well (Linn County, KS) was selected for cuttings desorption tests in association with an on-going coalbed gas research project at the Kansas Geological Survey. The samples were gathered December 19, 2002 by K. David Newell of the Kansas Geological Survey, with well site collection aided by Lawrence A. Weis (consultant for Meritage KCM). Samples were obtained during normal drilling of the well, with no cessation of drilling before zones of interest

(i.e., coals in the Cherokee Group) were penetrated. The well was drilled using an air rotary rig owned by MOKAT Drilling. Lag times for samples to reach the surface (important for assessing lost gas) were determined by periodically noting the time it took for cuttings to reach the surface following resumption of drilling after new pipe was added to the drill string.

Nine cuttings samples from the Pennsylvanian Cherokee Group were collected:

- Mulky coal at 484' to 487' depth (520 grams dry wt.)
- Flemming coal at 606' to 607' depth (921 grams dry wt.)
- Tebo coal at 647' to 649' depth (718 grams dry wt.)
- Rowe coal at 798' to 800' depth (865 grams dry wt.)
- shale at 820' depth, 18' above Riverton coal (680 grams dry wt.)
- Riverton "A" coal at 838' to 843' depth (1231 grams dry wt.)
- Riverton "B" coal at 864' to 868' depth (737 grams dry wt.)
- Riverton "C" coal at 874' to 875' depth (1564 grams dry wt.)
- Riverton "D" coal at 876' to 877' depth (1629 grams dry wt.)

The cuttings samples were caught in a kitchen strainer at the air stream exit by the mud pit. The samples were not washed before they were placed in desorption canisters. A temperature bath for the desorption canisters was on site, but temperatures were slightly depressed (low 60s) early on. The canistered samples were later that day transported to the laboratory at the Kansas Geological Survey and desorption measurements were continued at 66 to 69 degrees F ambient temperature. Desorption measurements were periodically made until the canisters produced no more gas upon testing for at least two successive days.

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 simply reading the difference in water level using the volumetric scale on the side of the burette.

The desorption canisters were both home-made, using PVC pipe and plumbing materials available at hardware stores, and commercial, obtained from SSD, Inc. in Grand Junction, CO. On average, the canisters were approximately 12.5 inches high (32 cm), 3 1/2 inches (9 cm) in diameter, and enclosed a volume of approximately 150 cubic inches (2450 cm^3).

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, OR). The atmospheric pressure was displayed in millibars on this instrument, however, this measurement was not the actual barometric pressure, but rather an altitude-compensated barometric pressure automatically converted to a sea-level-equivalent pressure. In order to translate this measurement to actual atmospheric pressure, a regression correlation was determined over several weeks by comparing readings from the Oregon Scientific instrument to that from a pressure transducer in the Petrophysics Laboratory in the Kansas Geological Survey in Lawrence, Kansas (Figure 1). The regression equation shown graphically in Figure 1 was entered into a spreadsheet and was used to automatically convert the millibar measurement to barometric pressure in psi.

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:

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

Customarily, standard temperature and pressure for gas volumetric measurements in the oil industry are 60 °F and 14.7 psi (see Dake, 1978, p. 13), therefore P_{stp}, V_{stp}, and T_{stp}, respectively, are pressure, volume and temperature at standard temperature and pressure, where standard temperature is degrees Rankine (°R = 460 + °F). P_{rig}, V_{rig}, and T_{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_{stp} becomes:

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

The conversion calculations in the spreadsheet were carried out in the English metric system, as this is the customary measure system used in American coal and oil industry. V is therefore converted to cubic feet; P is psia; T is °R.

The desorbed gas was summed over the time period for which the coal samples evolved all of their gas. In the case of well cuttings from Meritage KCM #6-32 Broyles well, the maximum time of desorption was 36 days.

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 cuttings sample is lifted from the bottom of the hole, or in the case of cuttings, when the drilled rock is cut and circulated off bottom. 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 an hour for cuttings samples.

LITHOLOGIC ANALYSIS

Upon removal from the canisters, the cuttings were washed of drilling mud, and dried in an oven at 150 °F for 1 to 3 days. After drying, the cuttings were weighed and then dry sieved into 5 size fractions: >0.0930", >0.0661", >0.0460", >0.0331", and <0.0331". For large sample sizes, the cuttings were ran through a sample splitter and a lesser portion (approximately 75 grams) were sieved and weighed, and the derived size-fraction ratios were applied to the entire sample.

The size fractions were then inspected and sorted by hand under a dissecting microscope. Three major lithologic categories were differentiated: coal, dark shales (generally Munsell rock colors N3 (dark gray), N2 (grayish black), and N1 (black) on dry surface), and lighter-colored lithologies and/or dark and light-colored carbonates. After sorting, and for every size class, each of these three lithologic categories was weighed and the proportion of coal dark shale and light-colored lithologies were determined for the entire cuttings sample based on the weight percentages.

DATA PRESENTATION

Data and analyses accompanying this report are presented in the following order: 1) lag time to surface for the well cuttings, 2) data tables for the desorption analyses, 3) lost-gas graphs, 4) "lithologic component sensitivity analyses" showing the interdependence of gas evolved from dark shale versus coal in each sample, 5) a summary component analysis for all samples showing relative reliability of the data from all the samples, and 6) a desorption graph for all the samples.

Graph of Lag-time to Surface for Well Cuttings (Figure 2)
Lag time to surface varied, but there is a general trend of longer lag times for greater depth. The lag times accepted for cuttings were taken to be a visual average of the trend (defined by the scatter of data points on this graph) at the depth at which the samples were taken.

Data Tables of the Desorption Analyses (Table 1)
These are the basic data used for lost-gas analysis and determination of total gas desorbed from the cuttings samples. 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.

Lost-Gas Graphs (Figures 3-11)
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 hour after canistering, thus data are presented in the lost-gas graphs for only up to one hour after canistering. Lost-gas volumes derived from this analysis are incorporated in the data tables described above.

"Lithologic Component Sensitivity Analyses" (Figures 12-20)
The rapidity of penetration of an air-drilled well makes collection of pure lithologies from relatively thin-bedded strata rather difficult. Mixed lithologies are more the norm rather than the exception. Some of this mixing is due to cavings from strata farther up hole. The mixing may also be due to collection of two or more successively drilled lithologies in the kitchen sieve at the exit line, or differential lifting of relatively less-dense coal compared to other lithologies, all of which are more dense than coal.

The total gas evolved from the sample is due to gas being desorbed from both the coal and dark shale. Both lithologies are capable of generating gas, albeit the coal will be richer in gas than the dark-colored shale. Even though dark-colored shale is less rich in sorbed gas than coal, if a sample has a large proportion of dark, organic-rich shale and only a minor amount of coal, the total volume of gas evolved from the dark-shale component may be considerable.

The total amount of gas evolved from a cuttings sample can be expressed by the following equation:

$$\text{Total gas } (cm^3) = [\text{weight}_{coal} \text{ (grams) X gas content}_{coal} \ (cm^3/\text{gram})] + [\text{weight}_{\text{dark shale}} \text{ (grams) X gas content}_{\text{dark shale}} \ (cm^3/\text{gram})]$$

A unique solution for *gas content*$_{coal}$ in this equation is not possible because *gas content*$_{dark\ shale}$ is not known exactly. An answer can only be expressed as a linear

solution to the above equation. The richer in gas the dark shales are, the poorer in gas the admixed coal has to be, and visa versa. If there is little dark shale in a sample, a relatively well constrained answer for *gas content*$_{coal}$ can be obtained. Conversely, if considerable dark shale is in a sample, the gas content of a coal will be hard to precisely determine.

The lithologic-component-sensitivity-analysis diagram therefore expresses the bivariant nature inherent in the determination of gas content in mixed cuttings. The gas content of dark shales in Kansas can vary greatly. Proprietary desorption analyses of dark shales in cores from southeastern Kansas have registered as much as 50 scf/ton, but can be as low as 2-4 scf/ton. For a general understanding of the lithologic-component-sensitivity-analyses diagrams, the calculated *gas content*$_{coal}$ is given for assumed *gas content*$_{dark\ shale}$ at 30 scf/ton and 50 scf/ton. For most samples gathered in east-central and northeastern Kansas, the resultant *gas content*$_{coal}$ is a negative number for 30 scf/ton and 50 scf/ton *gas content*$_{dark\ shale}$. The only conclusion is that the *gas content*$_{dark\ shale}$ or most samples taken from this region has to be lower than 30-50 scf/ton. Conversely though, to assume that all the gas evolved from a cuttings sample is derived solely from the coal would result in an erroneously high gas content for the coal.

In all the lithologic-component-sensitivity-analysis diagrams, a "break-even" point is noted where the gas content of the coal is equal to that of the dark shale. This "break-even" point corresponds to the minimum gas content assignable to the coal and maximum gas content assignable to the dark shale. It can also be thought of the scf/ton gas content of the cuttings sample minus the weight of any of the lighter-colored lithologies, which are assumed to have no inherent gas content.

Summary Component Analysis for all Samples (Figure 21)
This diagram is a summary of the individual "lithologic component sensitivity analyses" for each sample, all set at a common scale. The steeper the angle of the line for a sample, the more uncertainty is attached to the results (i.e., *gas content*$_{coal}$) for that sample. If the coal content is miniscule (i.e., < approximately 5%), the results are a better reflection of the *gas content*$_{dark\ shale}$.

Desorption Graph (Figure 22)
This is a desorption graph (gas content per weight vs. square root of time) for all the samples. The rate at which gas is evolved from the samples is thus comparable at a common scale.

RESULTS and DISCUSSION

The Riverton "D" sample had the greatest gas content at 82.6 scf/ton (assuming the admixed dark shales produce 3 scf/ton), followed by the Rowe coal at 64.3 scf/ton, and the Riverton "A" coal at 55.2 scf/ton. The Riverton "B" sample has the least gas of the four Riverton coal (32.1 scf/ton).

Maximum gas content (gas content calculated assuming no gas contribution by admixed dark shale), minimum gas content (gas content calculated assuming equal gas content for coal and admixed dark shale) and "most likely" gas content (gas content calculated with admixed dark shales desorbing 3 scf/ton) for all the coal samples are presented on Figure 21. According to this diagram, the Riverton "C" coal sample had the most tightly constrained results, which corresponds to the greatest percentage of coal (86%) captured in this sample. The Rowe, Flemming, and Riverton "D" samples also have good control and reasonably constrained results. The least constrained results are for the Mulky coal sample, which contained only 10% coal.

The value of 3 scf/ton for the dark shales is based on the assay of the gas content of the dark shale 18' above the uppermost Riverton coal. Core desorption analyses of shale in the stratigraphic vicinity of Riverton coal elsewhere in Kansas also yield comparable gas contents.

The Mulky and Tebo coals have high-gamma ray shales directly above them. The higher gamma ray reading commonly indicates higher organic content, which in turn likely increases gas content. The gas content of these high-gamma-ray shales may be greater than 3 scf/ton, but present data allow no reasonable estimate. Nevertheless, the maximum gas content that the dark shales associated with these two coals may have is less than 10 scf/ton, based on their "break-even points" determined by their sensitivity analyses.

REFERENCES

Dake, L.P., 1978, Fundamentals of Reservoir Engineering, Elsevier Scientific Publishing, New York, NY, 443 p.

Kissel, F.N., McCulloch, C.M., and Elder, C.H., 1975, The direct method of determining methane content of coals for ventilation design: U.S. Bureau of Mines, Report of Investigations, RI7767.

McLennan, J.D., Schafer, P.S., and Pratt, T.J., 1995, A guide to determining coalbed gas content: Gas Research Institute, Chicago, IL, Reference No. GRI-94/0396, 180 p.

FIGURES and TABLES

Correlation of Field Barometer to KGS Petrophysics Lab Barometer

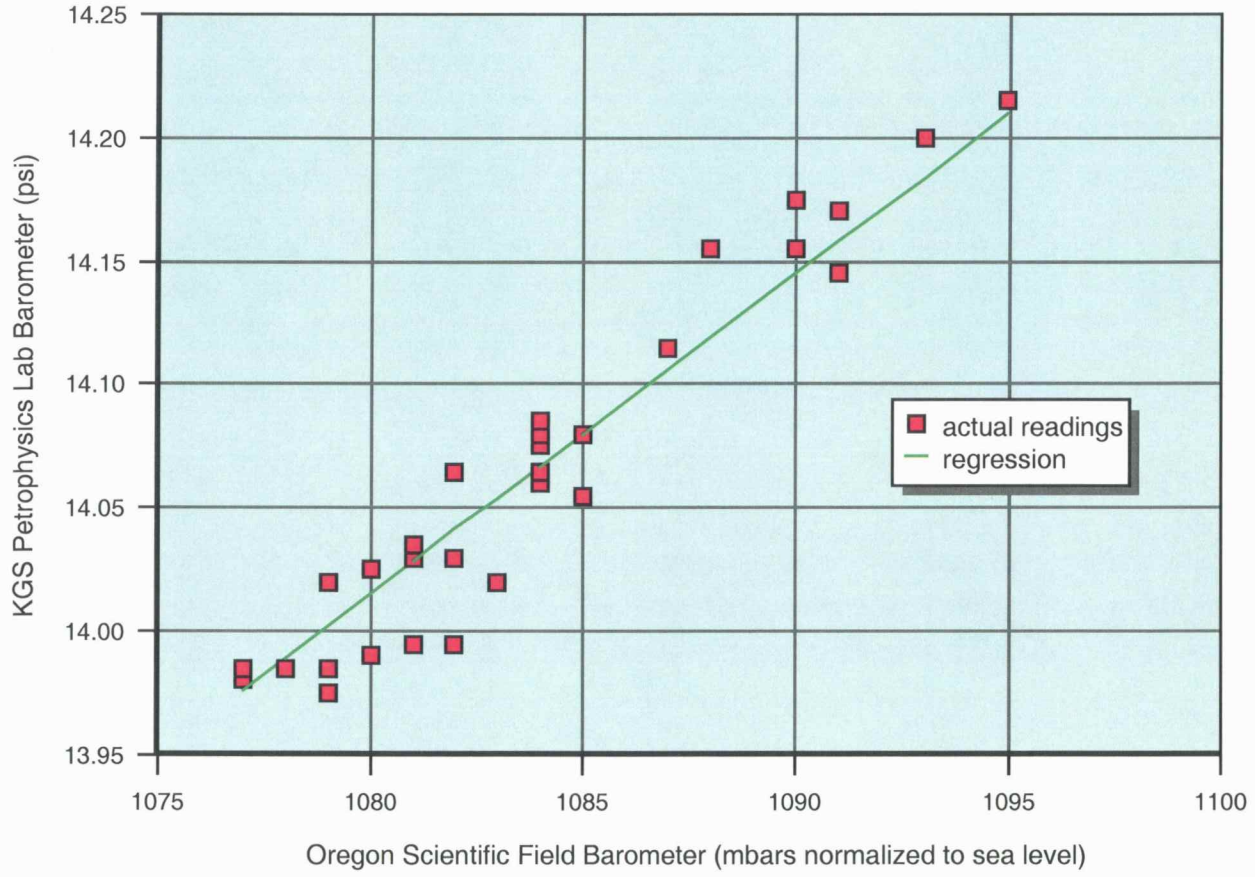

FIGURE 1.

Meritage KCM #6-32 Broyles; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
lag-time to surface for well cuttings (in seconds)

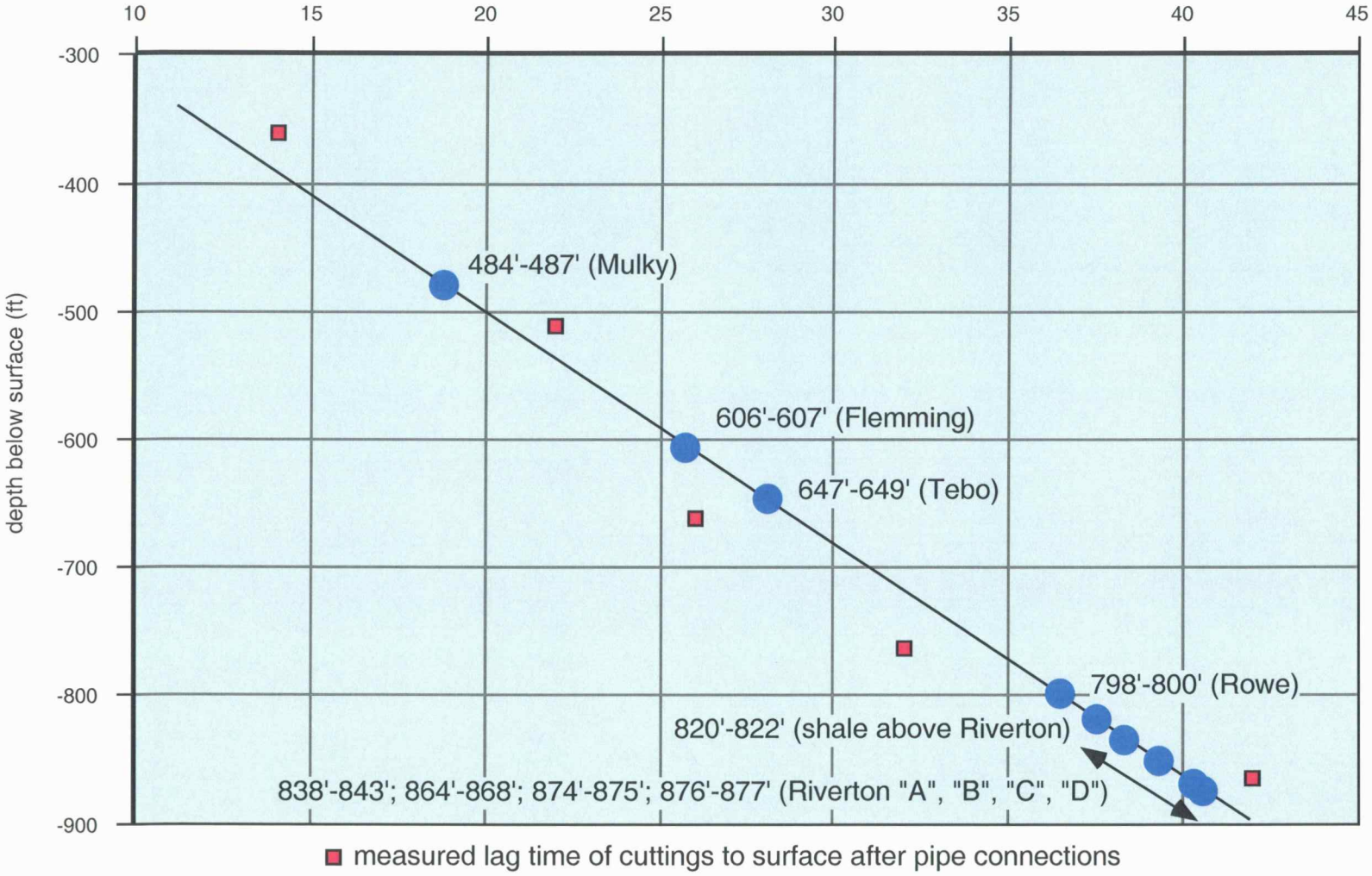

FIGURE 2.

Meritage KCM Broyles #6-32, SW SE 6-T.23S.-R.22E.

SAMPLE: 484' to 487' (Mulky coal) in canister Brady 27

DENSITIES:

DRY WEIGHT	lbs.	grams										est. lost gas (cc) =				TIME 0F:		at surface	elapsed time (off bottom to canistering)
sample weight:	1.1346	514.66										39				off bottom		in canister	2.7 minutes
CONVERSION OF VOLUMES TO STP																12/19/02	11:00	12/19/02 11:03	0.045 hours
RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE			0.211476293 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom		in canister	SQRT hrs. (since off bottom)		
12	61	1078	0.00042378	521	13.992	0.000402592	11.4001	0.000402592	11.4001	0.70964449	3.137353905	12/19/02	11:05	0:04:53		0:02:12	0.285287379		
2	61	1078	7.063E-05	521	13.992	6.70987E-05	1.90002	0.000469691	13.3001	0.827918571	3.255627987	12/19/02	11:06	0:05:36		0:02:55	0.305505046		
4	61	1078	0.00014126	521	13.992	0.000134197	3.80003	0.000603888	17.1002	1.064466735	3.49217615	12/19/02	11:06	0:06:14		0:03:33	0.322317993		
4	61	1078	0.00014126	521	13.992	0.000134197	3.80003	0.000738086	20.9002	1.301014898	3.728724313	12/19/02	11:07	0:07:04		0:04:23	0.343187672		
8	61	1078	0.00028252	521	13.992	0.000268395	7.60007	0.001006481	28.5003	1.774111224	4.201820639	12/19/02	11:08	0:07:49		0:05:08	0.360940131		
2	61	1078	7.063E-05	521	13.992	6.70987E-05	1.90002	0.00107358	30.4003	1.892385306	4.320094721	12/19/02	11:10	0:09:49		0:07:08	0.404488703		
3	61	1078	0.00010594	521	13.992	0.000100648	2.85003	0.001174228	33.2503	2.069796428	4.497505843	12/19/02	11:13	0:12:19		0:09:38	0.453075907		
4	61	1078	0.00014126	521	13.992	0.000134197	3.80003	0.001308425	37.0503	2.306344591	4.734054007	12/19/02	11:15	0:14:49		0:12:08	0.496935051		
7	61	1078	0.0002472	521	13.992	0.000234846	6.65006	0.001543271	43.7004	2.720303877	5.148013292	12/19/02	11:21	0:20:49		0:18:08	0.589019902		
7	61	1078	0.0002472	521	13.992	0.000234846	6.65006	0.001778116	50.3505	3.134263163	5.561972578	12/19/02	11:28	0:27:49		0:25:08	0.680889941		
3	61	1078	0.00010594	521	13.992	0.000100648	2.85003	0.001878764	53.2005	3.311674285	5.7393837	12/19/02	11:33	0:32:49		0:30:08	0.739556924		
1	61	1078	3.5315E-05	521	13.992	3.35494E-05	0.95001	0.001912314	54.1505	3.370811326	5.798520741	12/19/02	11:37	0:36:34		0:33:53	0.780669229		
6	61	1077	0.00021189	521	13.979	0.000201109	5.69476	0.002113423	59.8452	3.725304422	6.153013837	12/19/02	12:09	1:08:34		1:05:53	1.069007847		
5	61	1076	0.00017657	521	13.966	0.000167436	4.74123	0.002280859	64.5865	4.020441045	6.44815046	12/19/02	12:34	1:33:49		1:31:08	1.250444365		
2	61	1075	7.063E-05	521	13.953	6.6912E-05	1.89473	0.002347771	66.4812	4.138385978	6.566095393	12/19/02	13:25	2:24:49		2:22:08	1.553580095		
-10	60	1075	-0.0003531	520	13.953	-0.0003352	-9.4919	0.002012567	56.9893	3.547527227	5.975236643	12/19/02	13:57	2:56:19		2:53:38	1.714237764		
0	60	1075	0	520	13.953	0	0	0.002012567	56.9893	3.547527227	5.975236643	12/19/02	14:39	3:38:19		3:35:38	1.90751438		
2	60	1076	7.063E-05	520	13.966	6.7103E-05	1.90014	0.00207967	58.8895	3.665808905	6.09351832	12/19/02	15:32	4:31:19		4:28:38	2.126486408		
0	65	1078	0	525	13.992	0	0	0.00207967	58.8895	3.665808905	6.09351832	12/19/02	20:19	9:18:19		9:15:38	3.050455339		
0	69	1080	0	529	14.018	0	0	0.00207967	58.8895	3.665808905	6.09351832	12/20/02	10:27	23:26:19		23:23:38	4.841343936		

DECANISTERED 12/23/02

SAMPLE: 606' to 607' (Flemming coal) in canister Maggy 4

DRY WEIGHT	lbs.	grams										est. lost gas (cc) =				TIME 0F:		at surface	elapsed time (off bottom to canistering)
sample weight:	2.0126	912.92										32				off bottom		in canister	3.0 minutes
CONVERSION OF VOLUMES TO STP																12/19/02	11:37	12/19/02 11:40	0.050 hours
RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE			0.222984802 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom		in canister	SQRT hrs. (since off bottom)		
10	61	1086	0.00035315	521	14.096	0.000337983	9.57059	0.000337983	9.57059	0.335860049	1.458834222	12/19/02	11:43	0:05:26		0:02:27	0.300924501		
5	69	1086	0.00017657	529	14.096	0.000166436	4.71293	0.000504419	14.2835	0.501250489	1.624224662	12/19/02	11:43	0:06:06		0:03:07	0.318852108		
5	69	1086	0.00017657	529	14.096	0.000166436	4.71293	0.000670855	18.9964	0.666640929	1.789615102	12/19/02	11:45	0:07:26		0:04:27	0.351978535		
8	69	1086	0.00028252	529	14.096	0.000266298	7.54068	0.000937153	26.5371	0.931265634	2.054239806	12/19/02	11:47	0:09:56		0:06:57	0.406885187		
13	69	1086	0.00045909	529	14.096	0.000432734	12.2536	0.001369887	38.7907	1.361280778	2.484254951	12/19/02	11:53	0:15:56		0:12:57	0.515320828		
25	70	1086	0.00088287	530	14.096	0.00083061	23.5202	0.002200497	62.3109	2.186672691	3.309646864	12/19/02	12:08	0:30:41		0:27:42	0.715114598		
30	70	1086	0.00105944	530	14.096	0.000996732	28.2242	0.003197229	90.5351	3.177142987	4.30011716	12/19/02	12:33	0:55:56		0:52:57	0.965516557		
38	70	1086	0.00134196	530	14.096	0.001262527	35.7507	0.004459756	126.286	4.431738696	5.554712869	12/19/02	13:27	1:49:26		1:46:27	1.350514305		
11	70	1086	0.00038846	530	14.096	0.000365468	10.3489	0.004825225	136.635	4.794911138	5.91788531	12/19/02	13:59	2:21:26		2:18:27	1.535324794		
9	70	1086	0.00031783	530	14.096	0.00029902	8.46726	0.005124244	145.102	5.092052227	6.215026399	12/19/02	14:37	2:59:26		2:56:27	1.729322282		
17	70	1086	0.00060035	530	14.096	0.000564815	15.9937	0.005689059	161.096	5.653318728	6.7762929	12/19/02	15:34	3:56:26		3:53:27	1.985083262		
60	70	1086	0.00211889	530	14.096	0.001993464	56.4484	0.007682523	217.544	7.63425932	8.757233493	12/19/02	19:25	7:47:26		7:44:27	2.79115667	estimate	
16	70	1086	0.00056504	530	14.096	0.00053159	15.0529	0.008214113	232.597	8.162510145	9.285484317	12/19/02	20:20	8:42:26		8:39:27	2.950800268		
128	70	1085	0.00452029	530	14.083	0.004248807	120.312	0.012462921	352.909	12.38462539	13.50759956	12/20/02	10:24	22:46:26		22:43:27	4.772199586		
24	68	1078	0.00084756	528	13.992	0.00079451	22.4979	0.013257431	375.407	13.17414392	14.29711809	12/20/02	17:55	30:17:26		30:14:27	5.503685634		
36	65	1075	0.00127133	525	13.953	0.001195239	33.8453	0.01445267	409.252	14.36187441	15.48484858	12/21/02	17:49	54:11:26		54:08:27	7.361423473		
10	68	1089	0.00035315	528	14.135	0.000334424	9.46979	0.014787094	418.722	14.69419726	15.81717143	12/22/02	20:21	80:43:26		80:40:27	8.984647399		
8	67	1088	0.00028252	527	14.122	0.000267801	7.58324	0.015054894	426.306	14.96031542	16.08328959	12/23/02	18:59	103:21:26		103:18:27	10.16647541		
23	66	1083	0.00081224	526	14.057	0.000767845	21.7429	0.01582274	448.048	15.72333695	16.84631113	12/24/02	11:45	120:07:26		120:04:27	10.96010442		
125	70	1067	0.00441435	530	13.849	0.004080391	115.543	0.019903131	563.592	19.77809373	20.9010679	12/29/02	21:26	249:48:26		249:45:27	15.80529096		
1	70	1078	3.5315E-05	530	13.992	3.29797E-05	0.93388	0.01993611	564.526	19.8108662	20.93384037	12/30/02	17:10	269:32:26		269:29:27	16.41769032		
5	70	1082	0.00017657	530	14.044	0.00016551	4.68671	0.02010162	569.212	19.97533656	21.09831073	12/31/02	18:53	295:15:26		295:12:27	17.18305043		
-5	65	1081	-0.0001766	525	14.031	-0.00016693	-4.727	0.019934688	564.485	19.80945327	20.93242744	1/1/03	18:50	319:12:26		319:09:27	17.86637127		

DECANISTERED 1/01/03

SAMPLE: 647' to 649' (Tebo coal) in canister Maggy 2

DRY WEIGHT	lbs.	grams										est. lost gas (cc) =				TIME 0F:		at surface	elapsed time (off bottom to canistering)
sample weight:	1.5745	714.19										33				off bottom		in canister	3.0 minutes

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES — SCF/TON — SCF/TON — TIME OF MEASURE — TIME SINCE

12/19/02 11:49 — 12/19/02 11:52 — 0.050 hours

0.222984802 SQRT (hrs)

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas			off bottom	in canister	SQRT hrs. (since off bottom)
7	61	1077	0.0002472	521	13.979	0.000234628	6.64389	0.000234628	6.64389	0.29803085	1.778340895	12/19/02	11:55	0:05:44	0:02:45	0.309120616
14	61	1077	0.00049441	521	13.979	0.000469255	13.2878	0.000703883	19.9317	0.894092551	2.374402596	12/19/02	11:57	0:07:29	0:04:30	0.353160335
6	61	1077	0.00021189	521	13.979	0.000201109	5.69476	0.000904992	25.6264	1.149547566	2.629857611	12/19/02	11:58	0:08:59	0:06:00	0.386939559
5	61	1077	0.00017657	521	13.979	0.000167591	4.74564	0.001072584	30.3721	1.362426745	2.84273679	12/19/02	12:00	0:10:29	0:07:30	0.417997873
5	61	1077	0.00017657	521	13.979	0.000167591	4.74564	0.001240175	35.1177	1.575305923	3.055615968	12/19/02	12:02	0:12:44	0:09:45	0.460675832
8	61	1077	0.00028252	521	13.979	0.000268146	7.59302	0.001508321	42.7107	1.91591261	3.396222655	12/19/02	12:05	0:15:29	0:12:30	0.507991688
5	61	1077	0.00017657	521	13.979	0.000167591	4.74564	0.001675912	47.4564	2.128791788	3.609101833	12/19/02	12:07	0:17:59	0:15:00	0.547468924
6	61	1077	0.00021189	521	13.979	0.000201109	5.69476	0.001877021	53.1511	2.384246803	3.864556848	12/19/02	12:11	0:21:29	0:18:30	0.598377436
7	61	1077	0.0002472	521	13.979	0.000234628	6.64389	0.002111649	59.795	2.682277653	4.162587698	12/19/02	12:16	0:26:59	0:24:00	0.670613318
7	61	1076	0.0002472	521	13.966	0.00023441	6.63772	0.002346059	66.4327	2.980031781	4.460341826	12/19/02	12:23	0:33:29	0:30:30	0.747031161
8	61	1076	0.00028252	521	13.966	0.000267897	7.58597	0.002613956	74.0187	3.320322212	4.800632257	12/19/02	12:32	0:42:59	0:40:00	0.846397595
27	61	1075	0.0009535	521	13.953	0.000903312	25.5788	0.003517268	99.5976	4.467735056	5.948045101	12/19/02	13:28	1:38:29	1:35:30	1.281167003
9	60	1075	0.00031783	520	13.953	0.000301683	8.54268	0.003818951	108.14	4.850941525	6.33125157	12/19/02	13:59	2:10:14	2:07:15	1.473280542
5	60	1075	0.00017657	520	13.953	0.000167602	4.74593	0.003986552	112.886	5.063834008	6.544144053	12/19/02	14:33	2:43:29	2:40:30	1.650673263
10	60	1076	0.00035315	520	13.966	0.000335515	9.5007	0.004322067	122.387	5.490015053	6.970325098	12/19/02	15:35	3:45:29	3:42:30	1.938570493
14	65	1078	0.00049441	525	13.992	0.000466112	13.1988	0.00478818	135.586	6.08208456	7.562394605	12/19/02	20:22	8:32:29	8:29:30	2.922565464
52	69	1080	0.00183637	529	14.018	0.001721372	48.7436	0.006509551	184.329	8.268620545	9.74893059	12/20/02	10:22	22:32:29	22:29:30	4.747777258
0	68	1078	0	528	13.992	0	0	0.006509551	184.329	8.268620545	9.74893059	12/20/02	17:57	30:07:29	30:04:30	5.488599295

DECANISTERED 12/23/02

SAMPLE: 798' to 800' (Rowe coal) in canister Maggy 3

DRY WEIGHT — lbs. — grams — est. lost gas (cc) = — TIME 0F: 12/19/02 12:34 at surface — elapsed time (off bottom to canistering)

sample weight: 1.8440 — 836.42 — 106 — off bottom — in canister — 3.1 minutes

CONVERSION OF VOLUMES TO STP

RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES — SCF/TON — SCF/TON — TIME OF MEASURE — TIME SINCE

12/19/02 12:33 — 12/19/02 12:36 — 0.052 hours

0.227303028 SQRT (hrs)

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas			off bottom	in canister	SQRT hrs. (since off bottom)
30	61	1076	0.00105944	521	13.966	0.001004613	28.4474	0.001004613	28.4474	1.089608195	5.149682367	12/19/02	12:38	0:04:51	0:01:45	0.284312035
13	61	1076	0.00045909	521	13.966	0.000435333	12.3272	0.001439946	40.7746	1.561771746	5.621845918	12/19/02	12:39	0:05:51	0:02:45	0.3122499
12	61	1076	0.00042378	521	13.966	0.000401845	11.379	0.001841791	52.1535	1.997615024	6.057689196	12/19/02	12:40	0:06:51	0:03:45	0.337885582
10	61	1076	0.00035315	521	13.966	0.000334871	9.48246	0.002176663	61.636	2.360817755	6.420891928	12/19/02	12:41	0:07:51	0:04:45	0.361708907
12	61	1076	0.00042378	521	13.966	0.000401845	11.379	0.002578508	73.0149	2.796661033	6.856735205	12/19/02	12:42	0:09:06	0:06:00	0.389444048
8	61	1076	0.00028252	521	13.966	0.000267897	7.58597	0.002846405	80.6009	3.087223218	7.147297391	12/19/02	12:43	0:10:06	0:07:00	0.410284454
24	61	1076	0.00084756	521	13.966	0.000803691	22.7579	0.003650096	103.359	3.958909774	8.018983946	12/19/02	12:47	0:13:56	0:10:50	0.48189441
108	61	1075	0.003814	521	13.953	0.003613247	102.315	0.007263343	205.674	7.877853746	11.93792792	12/19/02	13:22	0:49:06	0:46:00	0.904617783
13	61	1075	0.00045909	521	13.953	0.000434928	12.3157	0.007698271	217.99	8.349578483	12.40965266	12/19/02	13:29	0:56:21	0:53:15	0.969106117
42	60	1075	0.00148322	520	13.953	0.001407854	39.8658	0.009106125	257.856	9.876543084	13.93661726	12/19/02	14:04	1:30:36	1:27:30	1.228820573
25	60	1075	0.00088287	520	13.953	0.000838008	23.7297	0.009944133	281.585	10.78545058	14.84552476	12/19/02	14:31	1:57:36	1:54:30	1.4
43	60	1076	0.00151854	520	13.966	0.001442715	40.853	0.011386849	322.438	12.35022574	16.41029991	12/19/02	14:36	2:02:36	1:59:30	1.429452109
109	65	1078	0.00384931	525	13.992	0.003629018	102.762	0.015015867	425.2	16.28627489	20.34634906	12/19/02	20:24	7:50:36	7:47:30	2.800595175
220	69	1080	0.00776926	529	14.018	0.007282726	206.223	0.022298593	631.423	24.18515137	28.24522554	12/20/02	10:19	21:45:36	21:42:30	4.664761516
52	68	1078	0.00183637	528	13.992	0.001721438	48.7455	0.024020031	680.169	26.05223057	30.11230474	12/20/02	17:58	29:24:36	29:21:30	5.423098745
83	65	1075	0.00293113	525	13.953	0.002755691	78.0322	0.026775722	758.201	29.04106468	33.10113885	12/21/02	17:50	53:16:36	53:13:30	7.299086701
60	68	1089	0.00211889	528	14.135	0.002006543	56.8187	0.028782264	815.02	31.21736971	35.27744388	12/22/02	20:24	79:50:36	79:47:30	8.935509685
34	67	1088	0.0012007	527	14.122	0.001138152	32.2288	0.029920417	847.249	32.45181474	36.51188891	12/23/02	19:00	102:26:36	102:23:30	10.12142941
37	66	1083	0.00130665	526	14.057	0.001235229	34.9777	0.031155646	882.226	33.79155002	37.85162419	12/24/02	11:46	119:12:36	119:09:30	10.91833321
145	70	1067	0.00512065	530	13.849	0.004733253	134.03	0.0358889	1016.26	38.92525739	42.98533157	12/29/02	21:28	248:54:36	248:51:30	15.77688182
7	70	1078	0.0002472	530	13.992	0.000230858	6.53713	0.036119757	1022.79	39.17564654	43.23572071	12/30/02	17:11	268:37:36	268:34:30	16.38983425
8	70	1082	0.00028252	530	14.044	0.000264816	7.49873	0.036384573	1030.29	39.46286737	43.52294154	12/31/02	18:55	294:21:36	294:18:30	17.1569228
-10	66	1081	-0.0003531	526	14.031	-0.00033323	-9.436	0.036051344	1020.86	39.10144543	43.1615196	1/1/03	18:55	318:21:36	318:18:30	17.84264554

DECANISTERED 1/01/03

SAMPLE: 820' (shale 18' above Riverton coal) in canister Stegeman 6

DRY WEIGHT — lbs. — grams — est. lost gas (cc) = — TIME 0F: 12/19/02 12:41 at surface — elapsed time (off bottom to canistering)

sample weight: 1.4980 — 679.5 — 35 — off bottom — in canister — 5.9 minutes

CONVERSION OF VOLUMES TO STP

12/19/02 12:40 — 12/19/02 12:46 — 0.098 hours

RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES — SCF/TON — SCF/TON — TIME OF MEASURE — TIME SINCE

0.312694384 SQRT (hrs)

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas			off bottom	in canister	SQRT hrs. (since off bottom)
19	61	1076	0.00067098	521	13.966	0.000636255	18.0167	0.000636255	18.0167	0.849449676	2.499628822	12/19/02	12:53	0:12:37	0:06:45	0.45856055
1	61	1075	3.5315E-05	521	13.953	3.3456E-05	0.94736	0.000669711	18.964	0.894116003	2.54429515	12/19/02	13:15	0:34:37	0:28:45	0.759568591
0	61	1075	0	521	13.953	0	0	0.000669711	18.964	0.894116003	2.54429515	12/19/02	13:31	0:50:37	0:44:45	0.918483049
-17	61	1075	-0.0006004	521	13.953	-0.00056875	-16.105	0.000100959	2.85884	0.134788434	1.78496758	12/19/02	13:46	1:05:37	0:59:45	1.045758629
4	60	1075	0.00014126	520	13.953	0.000134081	3.79675	0.000235041	6.65558	0.313797332	1.963976478	12/19/02	14:05	1:24:37	1:18:45	1.187551168

2	60	1075	7.063E-05	520	13.953	6.70407E-05	1.89837	0.000302081	8.55396	0.40330178	2.053480927	12/19/02	14:29	1:48:37	1:42:45	1.345465636
0	60	1076	0	520	13.966	0	0	0.000302081	8.55396	0.40330178	2.053480927	12/19/02	15:38	2:57:37	2:51:45	1.720545779
11	65	1078	0.00038846	525	13.992	0.000366231	10.3705	0.000668313	18.9244	0.892248626	2.542427772	12/19/02	20:35	7:54:37	7:48:45	2.812521605
13	69	1080	0.00045909	529	14.018	0.000430343	12.1859	0.001098655	31.1103	1.466789514	3.116968661	12/20/02	10:14	21:33:37	21:27:45	4.643304618
-6	68	1086	-0.0002119	528	14.096	-0.0002001	-5.6662	0.000898554	25.4441	1.199638604	2.84981775	12/20/02	17:59	29:18:37	29:12:45	5.413896728
-30	65	1088	-0.0010594	525	14.122	-0.00100808	-28.545	-0.00010952	-3.1014	-0.146222843	1.503956303	12/21/02	17:53	53:12:37	53:06:45	7.29453753
-28	69	1089	-0.0009888	529	14.135	-0.00093462	-26.465	-0.00104414	-29.567	-1.394007798	0.256171348	12/22/02	20:26	79:45:37	79:39:45	8.930860976

DECANISTERED 12/23/02

SAMPLE: 838' to 843' (Riverton "A" coal) in canister Brady 31

DRY WEIGHT lbs. grams — est. lost gas (cc) = 110 — TIME 0F: 12/19/02 12:47 at surface — elapsed time (off bottom to canistering)

sample weight: 2.4565 1114.24 — off bottom — in canister — 4.6 minutes

CONVERSION OF VOLUMES TO STP — 12/19/02 12:46 — 12/19/02 12:51 — 0.077 hours

RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES — SCF/TON — SCF/TON — TIME SINCE — 0.277388616 SQRT (hrs)

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom	in canister	SQRT hrs. (since off bottom)
30	61	1076	0.00105944	521	13.966	0.001004613	28.4474	0.001004613	28.4474	0.817929787	3.980691344	12/19/02	12:54	0:07:37	0:03:00	0.356292639
17	61	1076	0.00060035	521	13.966	0.000569281	16.1202	0.001573894	44.5676	1.281423333	4.44418489	12/19/02	12:55	0:09:22	0:04:45	0.395108986
23	61	1076	0.00081224	521	13.966	0.000770204	21.8097	0.002344098	66.3772	1.908502837	5.071264394	12/19/02	13:00	0:13:52	0:09:15	0.48074017
31	61	1075	0.00109476	521	13.953	0.001037136	29.3683	0.003381234	95.7455	2.752911454	5.915673011	12/19/02	13:09	0:23:22	0:18:45	0.624054841
11	61	1075	0.00038846	521	13.953	0.000368016	10.421	0.00374925	106.167	3.052540318	6.215301875	12/19/02	13:14	0:28:07	0:23:30	0.684551759
23	61	1075	0.00081224	521	13.953	0.000769488	21.7894	0.004518738	127.956	3.679037034	6.841798591	12/19/02	13:24	0:37:52	0:33:15	0.794425019
8	61	1075	0.00028252	521	13.953	0.000267648	7.57892	0.004786386	135.535	3.896948935	7.059710492	12/19/02	13:32	0:45:37	0:41:00	0.871939091
8	61	1075	0.00028252	521	13.953	0.000267648	7.57892	0.005054034	143.114	4.114860837	7.277622393	12/19/02	13:40	0:53:37	0:49:00	0.945310061
13	61	1075	0.00045909	521	13.953	0.000434928	12.3157	0.005488962	155.429	4.468967676	7.631729233	12/19/02	13:51	1:05:07	1:00:30	1.041766662
16	60	1075	0.00056504	520	13.953	0.000536325	15.187	0.006025287	170.616	4.905629601	8.068391158	12/19/02	14:07	1:20:37	1:16:00	1.159142403
9	60	1075	0.00031783	520	13.953	0.000301683	8.54268	0.00632697	179.159	5.151251934	8.314013491	12/19/02	14:27	1:40:37	1:36:00	1.294968897
50	60	1076	0.00176574	520	13.966	0.001677576	47.5035	0.008004546	226.663	6.517089816	9.679851373	12/19/02	15:40	2:53:37	2:49:00	1.70106176
79	65	1078	0.00278987	525	13.992	0.002630206	74.4789	0.010634752	301.141	8.658534056	11.82129561	12/19/02	20:26	7:39:37	7:35:00	2.767720683
151	69	1080	0.00533253	529	14.018	0.004998598	141.544	0.01563335	442.686	12.72826082	15.89102238	12/20/02	10:11	21:24:37	21:20:00	4.627124137
40	68	1078	0.00141259	528	13.992	0.001324183	37.4965	0.016957533	480.182	13.80637573	16.96913729	12/20/02	18:00	29:13:37	29:09:00	5.406195006
59	65	1075	0.00208357	525	13.953	0.001958864	55.4687	0.018916398	535.651	15.40123143	18.56399299	12/21/02	17:54	53:07:37	53:03:00	7.288823255
54	69	1089	0.001907	529	14.135	0.001802475	51.0402	0.020718872	586.691	16.86875873	20.03152029	12/22/02	20:28	79:41:37	79:37:00	8.92712782
26	67	1088	0.00091818	527	14.122	0.000870352	24.6455	0.021589224	611.336	17.57737619	20.74013775	12/23/02	19:01	102:14:37	102:10:00	10.11155829
31	66	1083	0.00109476	526	14.057	0.001034922	29.3056	0.022624146	640.642	18.41998235	21.58274391	12/24/02	11:47	119:00:37	118:56:00	10.90918319
125	70	1067	0.00441435	530	13.849	0.004080391	115.543	0.026704537	756.185	21.74212888	24.90489044	12/29/02	21:30	248:43:37	248:39:00	15.77107937
7	70	1078	0.0002472	530	13.992	0.000230858	6.53713	0.026935394	762.723	21.93008703	25.09284859	12/30/02	17:12	268:25:37	268:21:00	16.38374025
7	70	1082	0.0002472	530	14.044	0.000231714	6.56139	0.027167109	769.284	22.11874261	25.28150417	12/31/02	18:56	294:09:37	294:05:00	17.15110136
-7	66	1081	-0.0002472	526	14.031	-0.00023326	-6.6052	0.026933848	762.679	21.92882807	25.09158963	1/1/03	18:56	318:09:37	318:05:00	17.8370479
11	68	1087	0.00038846	528	14.109	0.000367191	10.3976	0.027301039	773.076	22.22778493	25.39054649	1/3/03	12:12	359:25:37	359:21:00	18.95855861
24	69	1077	0.00084756	529	13.979	0.000792272	22.4346	0.028093311	795.511	22.87283214	26.03559369	1/4/03	14:46	385:59:37	385:55:00	19.64672011
-4	68	1085	-0.0001413	528	14.083	-0.00013328	-3.774	0.027960033	791.737	22.76432057	25.92708213	1/5/03	15:03	410:16:37	410:12:00	20.25529423
8	69	1089	0.00028252	529	14.135	0.000267033	7.56151	0.028227066	799.298	22.98173202	26.14449358	1/7/03	13:37	456:50:37	456:46:00	21.37390023
5	66	1082	0.00017657	526	14.044	0.000166769	4.72235	0.028393835	804.021	23.11751075	26.28027231	1/9/03	13:19	504:32:37	504:28:00	22.46204824
4	69	1095	0.00014126	529	14.213	0.000134252	3.80159	0.028528087	807.822	23.22681541	26.38957696	1/11/03	17:58	557:11:37	557:07:00	23.60494887
8	67	1088	0.00028252	527	14.122	0.000267801	7.58324	0.028795888	815.406	23.44485155	26.60761311	1/13/03	16:01	603:14:37	603:10:00	24.56101812
12	69	1089	0.00042378	529	14.135	0.00040055	11.3423	0.029196438	826.748	23.77096873	26.93373028	1/15/03	15:25	650:38:37	650:34:00	25.5077167
-4	68	1098	-0.0001413	528	14.252	-0.00013488	-3.8192	0.029061563	822.929	23.66115702	26.82391858	1/17/03	14:15	697:28:37	697:24:00	26.4097888
13	67	1082	0.00045909	527	14.044	0.000432776	12.2548	0.029494339	835.184	24.01351185	27.1762734	1/19/03	12:24	743:37:37	743:33:00	27.2695241
-9	67	1092	-0.0003178	527	14.174	-0.00030238	-8.5625	0.029191955	826.621	23.76731938	26.93008094	1/21/03	10:11	789:24:37	789:20:00	28.096446
-16	67	1106	-0.000565	527	14.355	-0.00054446	-15.417	0.028647493	811.204	23.32403267	26.48679422	1/23/03	13:54	841:07:37	841:03:00	29.00218861

DECANIISTERED 1/24/03

SAMPLE: 864' to 868' (Riverton "B" coal) in canister A

DRY WEIGHT lbs. grams — est. lost gas (cc) = 44 — TIME 0F: 12/19/02 12:55 at surface — elapsed time (off bottom to canistering)

sample weight: 1.5650 709.87 — off bottom — in canister — 4.7 minutes

CONVERSION OF VOLUMES TO STP — 12/19/02 12:54 — 12/19/02 12:59 — 0.078 hours

RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES — SCF/TON — SCF/TON — TIME SINCE — 0.278388218 SQRT (hrs)

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom	in canister	SQRT hrs. (since off bottom)	
17	58	1076	0.00060035	518	13.966	0.000572578	16.2135	0.000572578	16.2135	0.731731207	2.717489409	12/19/02	13:03	0:08:54	0:04:15	0.385140667	
8	58	1075	0.00028252	518	13.953	0.000269198	7.62281	0.000841776	23.8364	1.075755282	3.061513484	12/19/02	13:08	0:14:24	0:09:45	0.489897949	
6	58	1075	0.00021189	518	13.953	0.000201899	5.71711	0.001043675	29.5535	1.333773338	3.31953154	12/19/02	13:18	0:24:09	0:19:30	0.634428877	
9	58	1075	0.00031783	518	13.953	0.000302848	8.57566	0.001346522	38.1291	1.720800422	3.706558624	12/19/02	13:33	0:39:09	0:34:30	0.807774721	
4	58	1075	0.00014126	518	13.953	0.000134599	3.81141	0.001481121	41.9405	1.89281246	3.878570661	12/19/02	13:41	0:47:24	0:42:45	0.888819442	
5	58	1075	0.00017657	518	13.953	0.000168249	4.76426	0.00164937	46.7048	2.107827506	4.093585708	12/19/02	13:52	0:58:09	0:53:30	0.984462628	estimate
7	59	1075	0.0002472	519	13.953	0.000235094	6.65711	0.001884465	53.3619	2.40826857	4.394026772	12/19/02	14:09	1:14:39	1:10:00	1.115422192	

4	59	1075	0.00014126	519	13.953	0.00013434	3.80406	0.002018804	57.166	2.579949178	4.56570738	12/19/02	14:26	1:31:39	1:27:00	1.235920709
6	59	1075	0.00021189	519	13.953	0.00020151	5.70609	0.002220314	62.872	2.837470089	4.823228291	12/19/02	14:56	2:01:39	1:57:00	1.423903087
10	60	1076	0.00035315	520	13.966	0.000335515	9.5007	0.002555829	72.3727	3.26624471	5.252002912	12/19/02	15:41	2:46:39	2:42:00	1.666583331
29	65	1078	0.00102413	525	13.992	0.000965519	27.3403	0.003521348	99.7131	4.500137992	6.485896194	12/19/02	20:28	7:33:39	7:29:00	2.749696953
47	69	1080	0.0016598	529	14.018	0.001555855	44.0567	0.005077203	143.77	6.488457097	8.474215299	12/20/02	10:10	21:15:39	21:11:00	4.610947119
2	68	1078	7.063E-05	528	13.992	6.62092E-05	1.87483	0.005143412	145.645	6.573069685	8.558827887	12/20/02	18:01	29:06:39	29:02:00	5.39544561
- 3	65	1075	-0.0001059	525	13.953	-9.9603E-05	-2.8204	0.005043809	142.824	6.445780777	8.431538979	12/21/02	17:54	52:59:39	52:55:00	7.279709243
6	69	1089	0.00021189	529	14.135	0.000200275	5.67113	0.005244084	148.495	6.701723981	8.687482183	12/22/02	20:28	79:33:39	79:29:00	8.919687962
3	67	1088	0.00010594	527	14.122	0.000100425	2.84371	0.005344509	151.339	6.830063285	8.815821487	12/23/02	19:02	102:07:39	102:03:00	10.10581516
12	66	1083	0.00042378	526	14.057	0.000400615	11.3441	0.005745124	162.683	7.342032801	9.327791003	12/24/02	11:49	118:54:39	118:50:00	10.9046244
51	70	1067	0.00180105	530	13.849	0.001664799	47.1417	0.007409923	209.825	9.469578367	11.45533657	12/29/02	21:32	248:37:39	248:33:00	15.76792631
- 4	70	1078	-0.0001413	530	13.992	-0.00013192	-3.7355	0.007278005	206.089	9.300991777	11.28674998	12/30/02	17:13	268:18:39	268:14:00	16.38019638
- 1	70	1082	-3.531E-05	530	14.044	-3.3102E-05	-0.9373	0.007244903	205.152	9.258688741	11.24444694	12/31/02	18:57	294:02:39	293:58:00	17.14771608

DECANISTERED 1/01/03

SAMPLE: 874' to 875' (Riverton "C" coal) in canister B

DRY WEIGHT	lbs.	grams									est. lost gas (cc) =			TIME 0F:		at surface 12/19/02	13:01 elapsed time (off bottom to canistering)
sample weight:	3.3752	1530.95									165			off bottom		in canister	7.7 minutes
CONVERSION OF VOLUMES TO STP														12/19/02	13:00	12/19/02 13:08	0.128 hours
RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE			0.357848509 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom		in canister	SQRT hrs. (since off bottom)
30	58	1075	0.00105944	518	13.953	0.001009493	28.5855	0.001009493	28.5855	0.598188306	4.05102031	12/19/02	13:10	0:10:26		0:02:45	0.416999867
58	58	1075	0.00204826	518	13.953	0.001951686	55.2654	0.002961178	83.8509	1.754685699	5.207517702	12/19/02	13:20	0:19:41		0:12:00	0.572761343
70	58	1075	0.00247204	518	13.953	0.002355483	66.6996	0.005316661	150.551	3.150458414	6.603290417	12/19/02	13:34	0:34:11		0:26:30	0.754799458
27	58	1075	0.0009535	518	13.953	0.000908543	25.727	0.006225205	176.278	3.68882789	7.141659893	12/19/02	13:44	0:43:56		0:36:15	0.855699844
31	58	1075	0.00109476	518	13.953	0.001043142	29.5384	0.007268347	205.816	4.306955806	7.75978781	12/19/02	13:54	0:54:26		0:46:45	0.952482138
43	59	1075	0.00151854	519	13.953	0.001444152	40.8937	0.008712499	246.71	5.162707016	8.615539019	12/19/02	14:10	1:09:41		1:02:00	1.077677544
30	59	1075	0.00105944	519	13.953	0.001007548	28.5305	0.009720046	275.24	5.759742744	9.212574747	12/19/02	14:25	1:24:41		1:17:00	1.188018893
35	59	1076	0.00123602	519	13.966	0.001176566	33.3165	0.010896612	308.557	6.456932372	9.909764375	12/19/02	14:44	1:43:41		1:36:00	1.314555269
88	60	1076	0.0031077	520	13.966	0.002952533	83.6061	0.013849145	392.163	8.206495268	11.65932727	12/19/02	15:42	2:41:41		2:34:00	1.64156091
185	65	1078	0.00653324	525	13.992	0.006159343	174.413	0.020008488	566.575	11.85629593	15.30912793	12/19/02	20:30	7:29:41		7:22:00	2.737649032
386	69	1080	0.01363151	529	14.018	0.012777874	361.828	0.032786362	928.403	19.42799505	22.88082705	12/20/02	10:05	21:04:41		20:57:00	4.591084355
112	68	1078	0.00395526	528	13.992	0.003707713	104.99	0.036494075	1033.39	21.6250495	25.07788151	12/20/02	18:02	29:01:41		28:54:00	5.38776907
164	65	1075	0.00579163	525	13.953	0.005444979	154.184	0.041939054	1187.58	24.8515443	28.3043763	12/21/02	17:55	52:54:41		52:47:00	7.274021507
127	69	1089	0.00448498	529	14.135	0.004239153	120.039	0.046178207	1307.62	27.36351106	30.81634306	12/22/02	20:30	79:29:41		79:22:00	8.915981282
69	67	1088	0.00243672	527	14.122	0.00230978	65.4054	0.048487987	1373.02	28.7322018	32.18503381	12/23/02	19:03	102:02:41		101:55:00	10.10171878
60	66	1083	0.00211889	526	14.057	0.002003075	56.7205	0.050491062	1429.74	29.91915043	33.37198244	12/24/02	11:50	118:49:41		118:42:00	10.90082821
251	70	1067	0.00886401	530	13.849	0.008193425	232.011	0.058684487	1661.75	34.77427337	38.22710537	12/29/02	21:33	248:32:41		248:25:00	15.76530121
28	70	1078	0.00098881	530	13.992	0.00092343	26.1485	0.059607917	1687.9	35.32146429	38.77429629	12/30/02	17:14	268:13:41		268:06:00	16.37766942
20	70	1082	0.0007063	530	14.044	0.000662041	18.7468	0.060269958	1706.65	35.71376523	39.16659723	12/31/02	18:58	293:57:41		293:50:00	17.14530224
- 7	66	1081	-0.0002472	526	14.031	-0.00023326	-6.6052	0.060036697	1700.04	35.57554362	39.02837562	1/1/03	18:58	317:57:41		317:50:00	17.83147187
24	68	1087	0.00084756	528	14.109	0.000801143	22.6858	0.06083784	1722.73	36.05027159	39.50310359	1/3/03	12:13	359:12:41		359:05:00	18.95287284
37	69	1077	0.00130665	529	13.979	0.00122142	34.5866	0.06205926	1757.32	36.77404015	40.22687216	1/4/03	14:47	385:46:41		385:39:00	19.64123355
- 1	68	1085	-3.531E-05	528	14.083	-3.332E-05	-0.9435	0.06202594	1756.37	36.75429621	40.20712822	1/5/03	15:03	410:02:41		409:55:00	20.24956104
14	69	1088	0.00049441	529	14.122	0.000466879	13.2205	0.06249282	1769.59	37.03095166	40.48378366	1/7/03	13:37	456:36:41		456:29:00	21.36846716
11	66	1082	0.00038846	526	14.044	0.000366891	10.3892	0.062859711	1779.98	37.24835798	40.70118998	1/9/03	13:20	504:19:41		504:12:00	22.45724951
7	67	1095	0.0002472	527	14.213	0.000235833	6.67802	0.063095544	1786.66	37.38810401	40.84093602	1/11/03	17:59	556:58:41		556:51:00	23.60038253
13	67	1088	0.00045909	527	14.122	0.000435176	12.3228	0.06353072	1798.98	37.64597328	41.09880529	1/13/03	15:59	602:58:41		602:51:00	24.55561149
20	69	1089	0.0007063	529	14.135	0.000667583	18.9038	0.064198303	1817.89	38.0415586	41.4943906	1/15/03	15:23	650:22:41		650:15:00	25.50251077
- 3	68	1098	-0.0001059	528	14.252	-0.00010116	-2.8644	0.064097147	1815.02	37.9816171	41.4344491	1/17/03	14:14	697:13:41		697:06:00	26.40507632
25	67	1082	0.00088287	527	14.044	0.000832262	23.5669	0.064929408	1838.59	38.47478479	41.92761679	1/19/03	12:22	743:21:41		743:14:00	27.26465457
-12	67	1092	-0.0004238	527	14.174	-0.00040318	-11.417	0.064526231	1827.17	38.23587649	41.68870849	1/21/03	10:10	789:09:41		789:02:00	28.09201646
-13	67	1106	-0.0004591	527	14.355	-0.00044238	-12.527	0.064083855	1814.65	37.973741	41.426573	1/23/03	13:58	840:57:41		840:50:00	28.99933428

DECANISTERED 1/23/03

SAMPLE: 876' to 877' (Riverton "D" coal) in canister 11

DRY WEIGHT	lbs.	grams									est. lost gas (cc) =			TIME 0F:		at surface 12/19/02	12:58 elapsed time (off bottom to canistering)
sample weight:	3.3037	1498.544									145			off bottom		in canister	4.4 minutes
CONVERSION OF VOLUMES TO STP														12/19/02	12:57	12/19/02 13:01	0.073 hours
RIG MEASUREMENTS			CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON			TIME SINCE			0.269258240 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	cubic ft (@STP)	cc (@STP)	without lost gas	with lost gas	TIME OF MEASURE		off bottom		in canister	SQRT hrs. (since off bottom)
140	61	1076	0.00494407	521	13.966	0.004688196	132.754	0.004688196	132.754	2.838128478	5.938052249	12/19/02	13:13	0:15:56		0:11:35	0.515320828
59	61	1076	0.00208357	521	13.966	0.00197574	55.9465	0.006663936	188.701	4.034196908	7.134120679	12/19/02	13:20	0:23:26		0:19:05	0.624944442
70	61	1076	0.00247204	521	13.966	0.002344098	66.3772	0.009008034	255.078	5.453261147	8.553184918	12/19/02	13:35	0:38:26		0:34:05	0.800347147
30	61	1076	0.00105944	521	13.966	0.001004613	28.4474	0.010012648	283.526	6.061431536	9.161355306	12/19/02	13:45	0:47:56		0:43:35	0.893805845

28	61	1075	0.00098881	521	13.953	0.000936768	26.5262	0.010949416	310.052	6.628529698	9.728453469	12/19/02	13:56	0:58:41	0:54:20	0.988966913	
30	61	1075	0.00105944	521	13.953	0.00100368	28.4209	0.011953096	338.473	7.236134872	10.33605864	12/19/02	14:12	1:14:41	1:10:20	1.115671198	
20	60	1075	0.0007063	520	13.953	0.000670407	18.9837	0.012623502	357.456	7.641983969	10.74190774	12/19/02	14:22	1:24:41	1:20:20	1.188018893	
21	60	1075	0.00074161	520	13.953	0.000703927	19.9329	0.013327429	377.389	8.068125521	11.16804929	12/19/02	14:41	1:43:41	1:39:20	1.314555269	
43	60	1076	0.00151854	520	13.966	0.001442715	40.853	0.014770144	418.242	8.941512778	12.04143655	12/19/02	15:44	2:46:41	2:42:20	1.666749998	
120	65	1078	0.00423778	525	13.992	0.00399525	113.132	0.018765394	531.375	11.36014688	14.46007065	12/19/02	20:33	7:35:41	7:31:20	2.755852359	estimate
489	69	1080	0.01726894	529	14.018	0.016187514	458.378	0.034952908	989.752	21.15970313	24.2596269	12/20/02	9:58	21:00:41	20:56:20	4.583818156	
145	68	1078	0.00512065	528	13.992	0.004800164	135.925	0.039753071	1125.68	24.06561413	27.1655379	12/20/02	18:04	29:06:41	29:02:20	5.395497094	
180	66	1075	0.00635666	526	13.953	0.005964835	168.905	0.045717906	1294.58	27.67659088	30.77651465	12/21/02	17:59	53:01:41	52:57:20	7.282036498	
127	69	1089	0.00448498	529	14.135	0.004239153	120.039	0.04995706	1414.62	30.2428789	33.34280267	12/22/02	20:32	79:34:41	79:30:20	8.920653314	
71	67	1088	0.00250735	527	14.122	0.00237673	67.3012	0.05233379	1481.92	31.68169768	34.78162145	12/23/02	19:04	102:06:41	102:02:20	10.10501801	
73	66	1083	0.00257798	526	14.057	0.002437074	69.01	0.054770864	1550.93	33.15704761	36.25697138	12/24/02	11:52	118:54:41	118:50:20	10.90464987	
294	70	1067	0.01038255	530	13.849	0.009597079	271.758	0.064367943	1822.69	38.96690334	42.06682711	12/29/02	21:36	248:38:41	248:34:20	15.76847241	
44	70	1070	0.00155385	530	13.888	0.001440336	40.7856	0.065808279	1863.48	39.83885027	42.93877404	12/30/02	17:15	268:17:41	268:13:20	16.37970458	
30	70	1082	0.00105944	530	14.044	0.000993061	28.1202	0.06680134	1891.6	40.44002693	43.5399507	12/31/02	19:04	294:06:41	294:02:20	17.14967606	
-5	66	1081	-0.0001766	526	14.031	-0.00016661	-4.718	0.066634725	1886.88	40.33916218	43.43908595	1/1/03	18:58	318:00:41	317:56:20	17.83287383	
33	68	1087	0.00116539	528	14.109	0.001101572	31.1929	0.067736297	1918.07	41.00602888	44.10595265	1/3/03	12:14	359:16:41	359:12:20	18.95463151	
44	69	1077	0.00155385	529	13.979	0.001452499	41.13	0.069188796	1959.2	41.88533921	44.98526298	1/4/03	14:49	385:51:41	385:47:20	19.64335483	
3	68	1085	0.00010594	528	14.083	9.99586E-05	2.8305	0.069288755	1962.03	41.94585191	45.04577568	1/5/03	15:01	410:03:41	409:59:20	20.24997257	
25	69	1088	0.00088287	529	14.122	0.000833713	23.608	0.070122468	1985.64	42.45056282	45.5504866	1/7/03	13:38	456:40:41	456:36:20	21.37002704	
21	66	1082	0.00074161	526	14.044	0.000700429	19.8339	0.070822897	2005.47	42.87458667	45.97451044	1/9/03	13:21	504:23:41	504:19:20	22.45873376	
11	67	1095	0.00038846	527	14.213	0.000370595	10.494	0.071193491	2015.97	43.09893645	46.19886022	1/11/03	18:00	557:02:41	556:58:20	23.60179489	
12	67	1088	0.00042378	527	14.122	0.000401701	11.3749	0.071595192	2027.34	43.34211709	46.44204086	1/13/03	15:58	603:00:41	602:56:20	24.55629021	
26	69	1089	0.00091818	529	14.135	0.000867858	24.5749	0.07246305	2051.92	43.86749889	46.96742266	1/15/03	15:22	650:24:41	650:20:20	25.50316429	
0	68	1098	0	528	14.252	0	0	0.07246305	2051.92	43.86749889	46.96742266	1/17/03	14:10	697:12:41	697:08:20	26.40476072	
28	67	1082	0.00098881	527	14.044	0.000932133	26.395	0.073395183	2078.31	44.43179122	47.53171499	1/19/03	12:20	743:22:41	743:18:20	27.26496022	
-11	67	1092	-0.0003885	527	14.174	-0.00036958	-10.465	0.073025604	2067.85	44.20805609	47.30797986	1/21/03	10:08	789:10:41	789:06:20	28.0923131	
-23	67	1106	-0.0008122	527	14.355	-0.00078266	-22.163	0.07224294	2045.68	43.73424872	46.83417249	1/23/03	13:52	840:54:41	840:50:20	28.99847218	

DECANISTERED 1/23/03

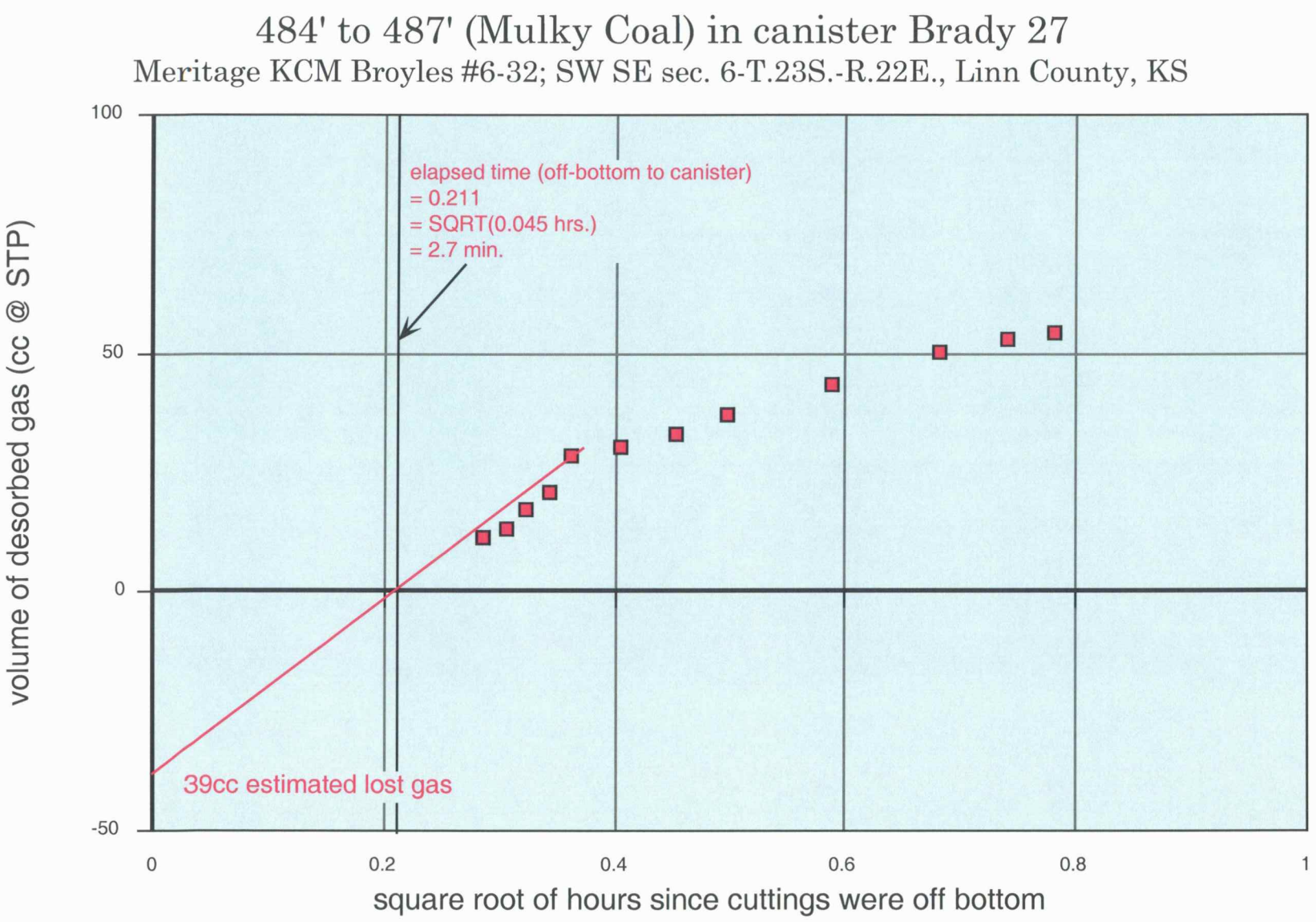
484' to 487' (Mulky Coal) in canister Brady 27
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
volume of desorbed gas (cc @ STP)
100
50
0
-50
elapsed time (off-bottom to canister)
= 0.211
= SQRT(0.045 hrs.)
= 2.7 min.
39cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 3.

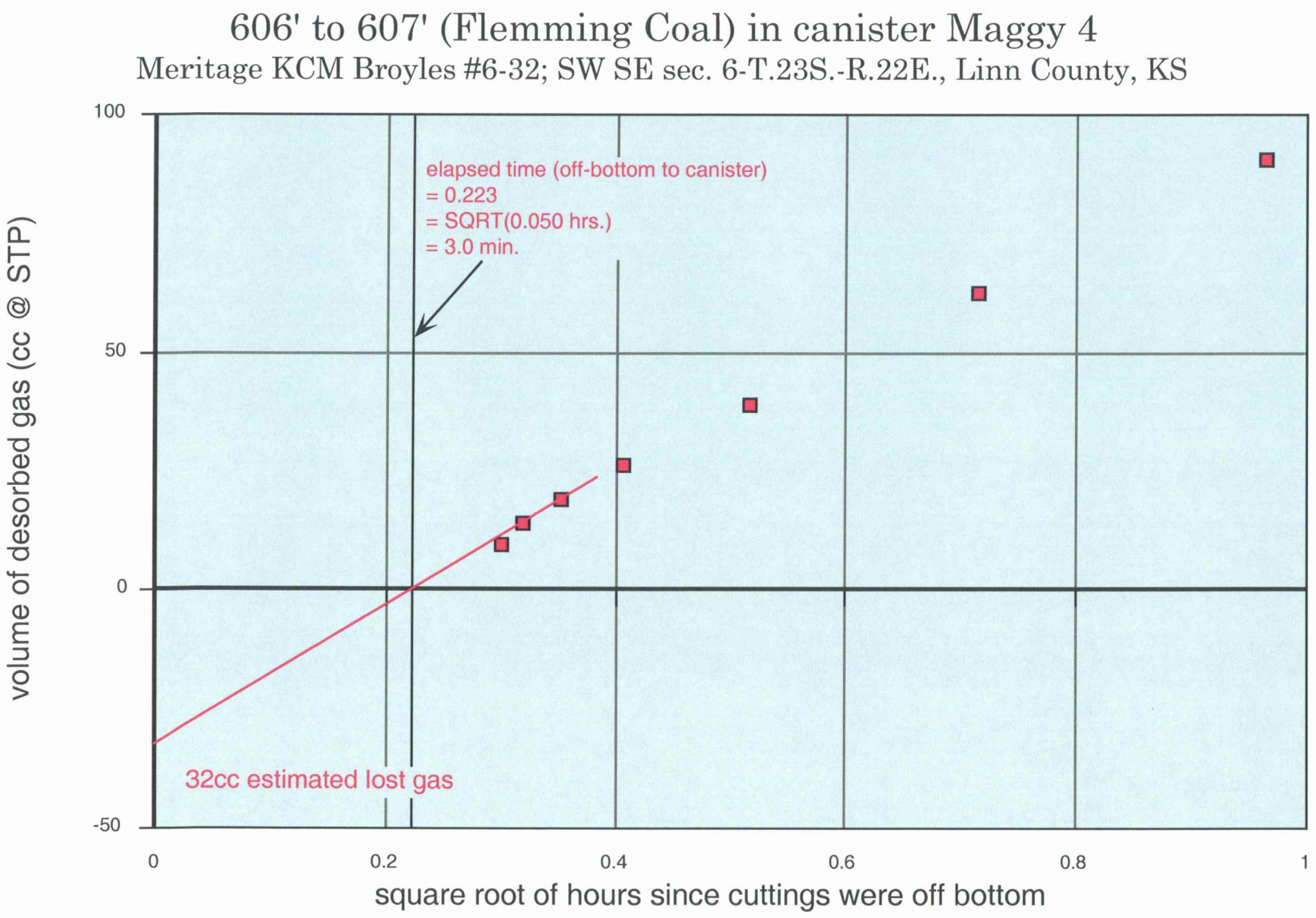
606' to 607' (Flemming Coal) in canister Maggy 4
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
volume of desorbed gas (cc @ STP)
100
50
0
-50
elapsed time (off-bottom to canister)
= 0.223
= SQRT(0.050 hrs.)
= 3.0 min.
32cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 4.

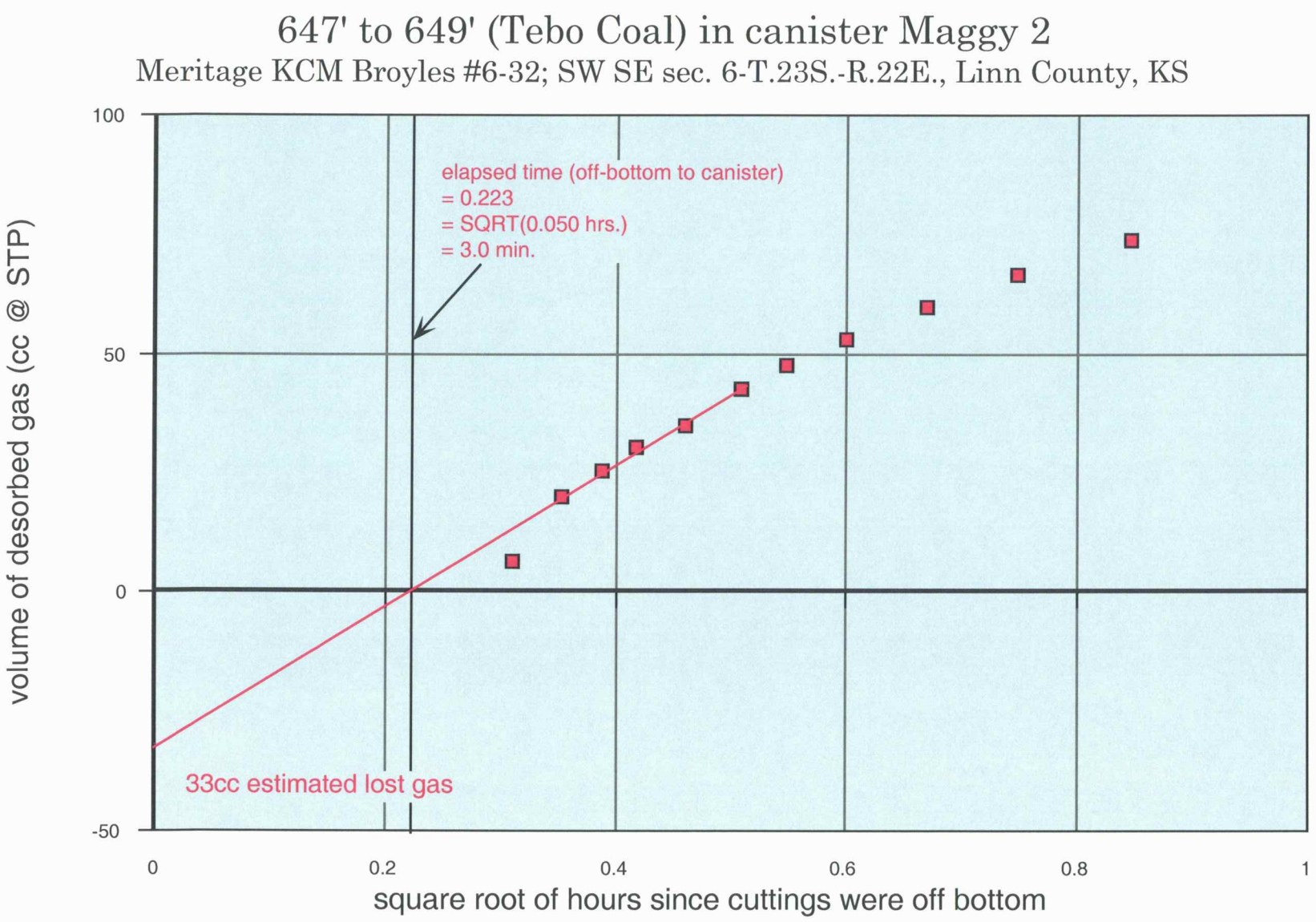
647' to 649' (Tebo Coal) in canister Maggy 2
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
volume of desorbed gas (cc @ STP)
100
50
0
-50
elapsed time (off-bottom to canister)
= 0.223
= SQRT(0.050 hrs.)
= 3.0 min.
33cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 5.

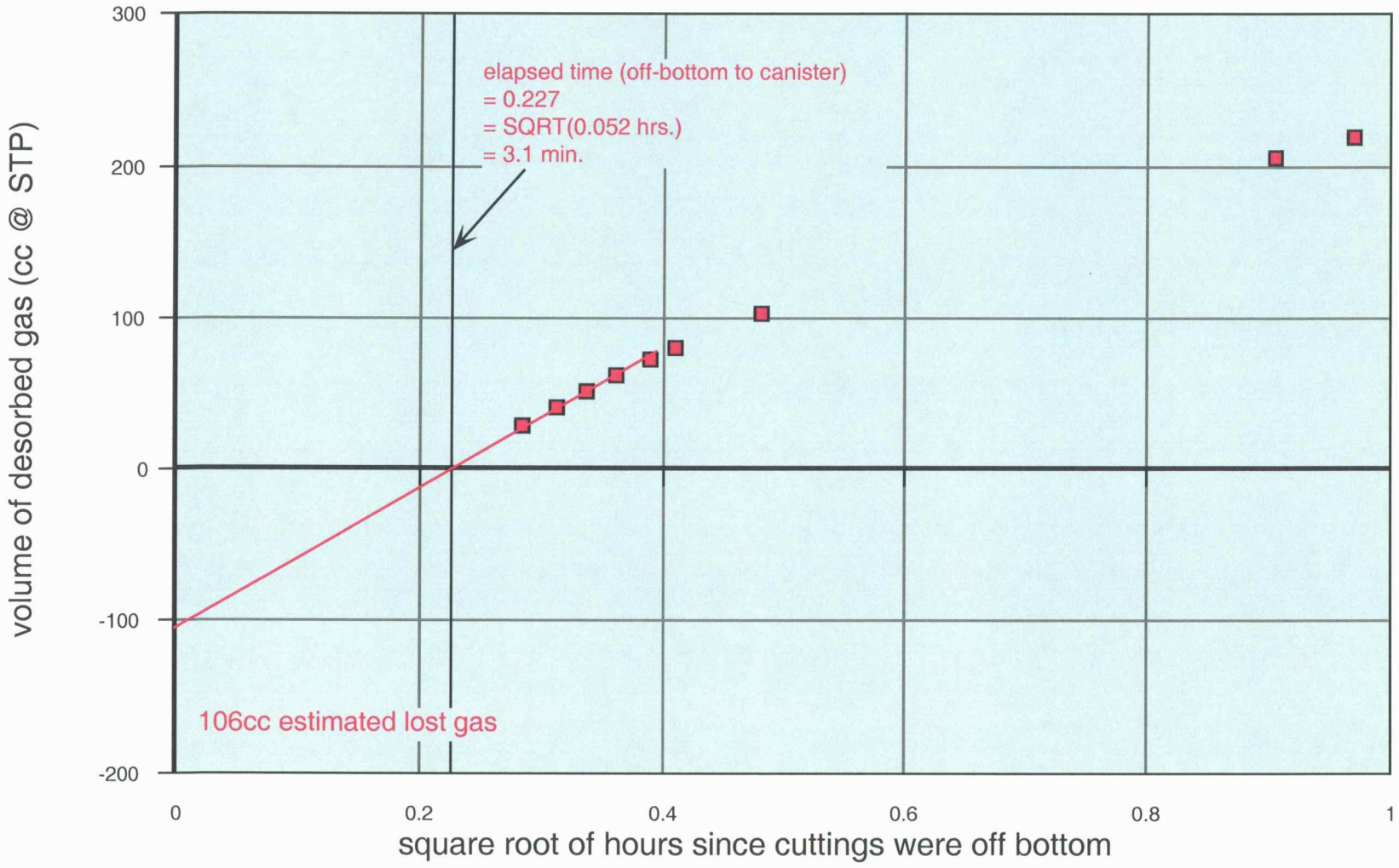
798' to 800' (Rowe Coal) in canister Maggy 3
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
volume of desorbed gas (cc @ STP)
300
200
100
0
-100
-200
elapsed time (off-bottom to canister)
= 0.227
= SQRT(0.052 hrs.)
= 3.1 min.
106cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 6.

820' to 821' (shale 18' above Riverton Coal) in canister Stegeman 6

Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS

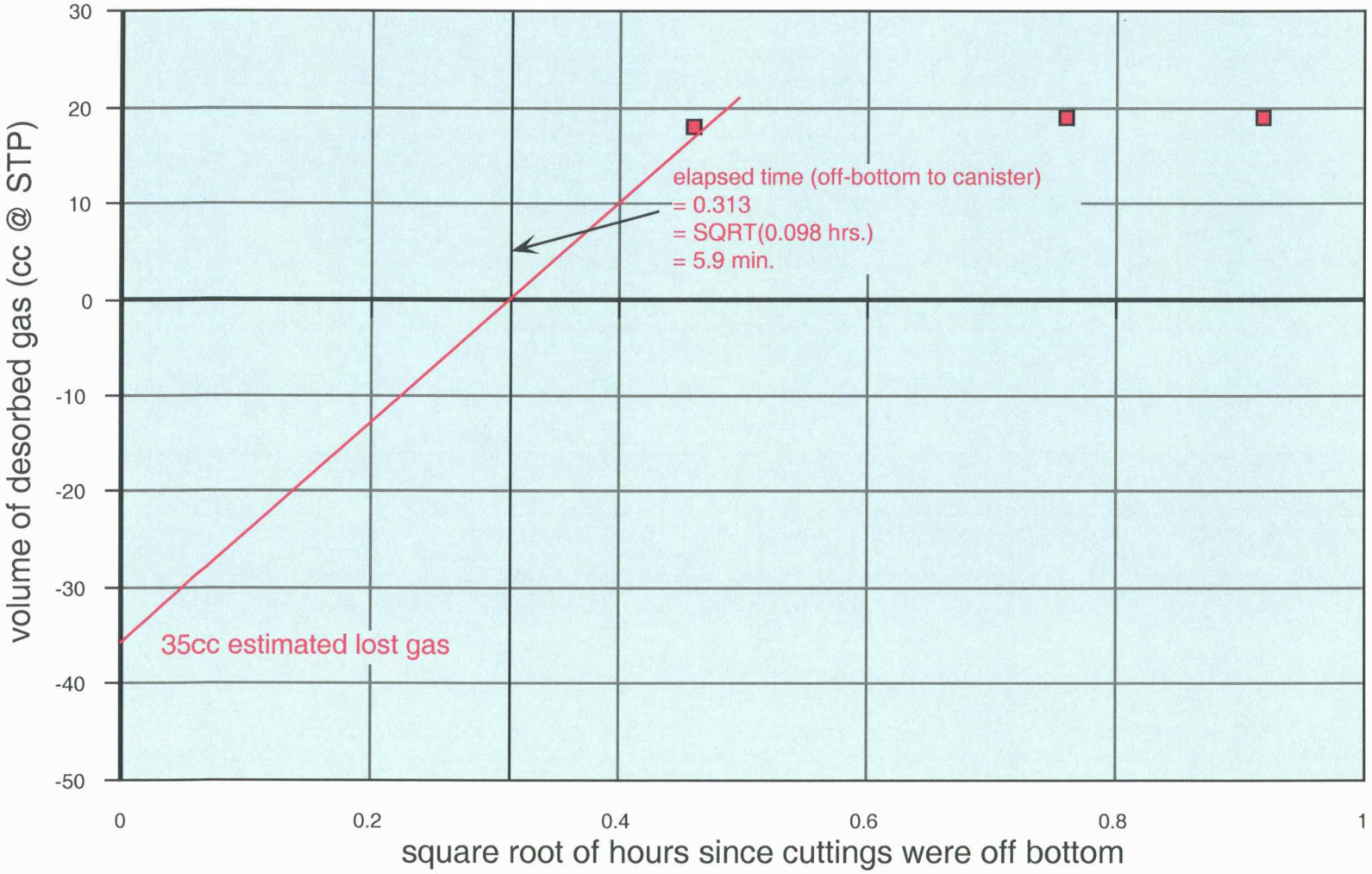

FIGURE 7.

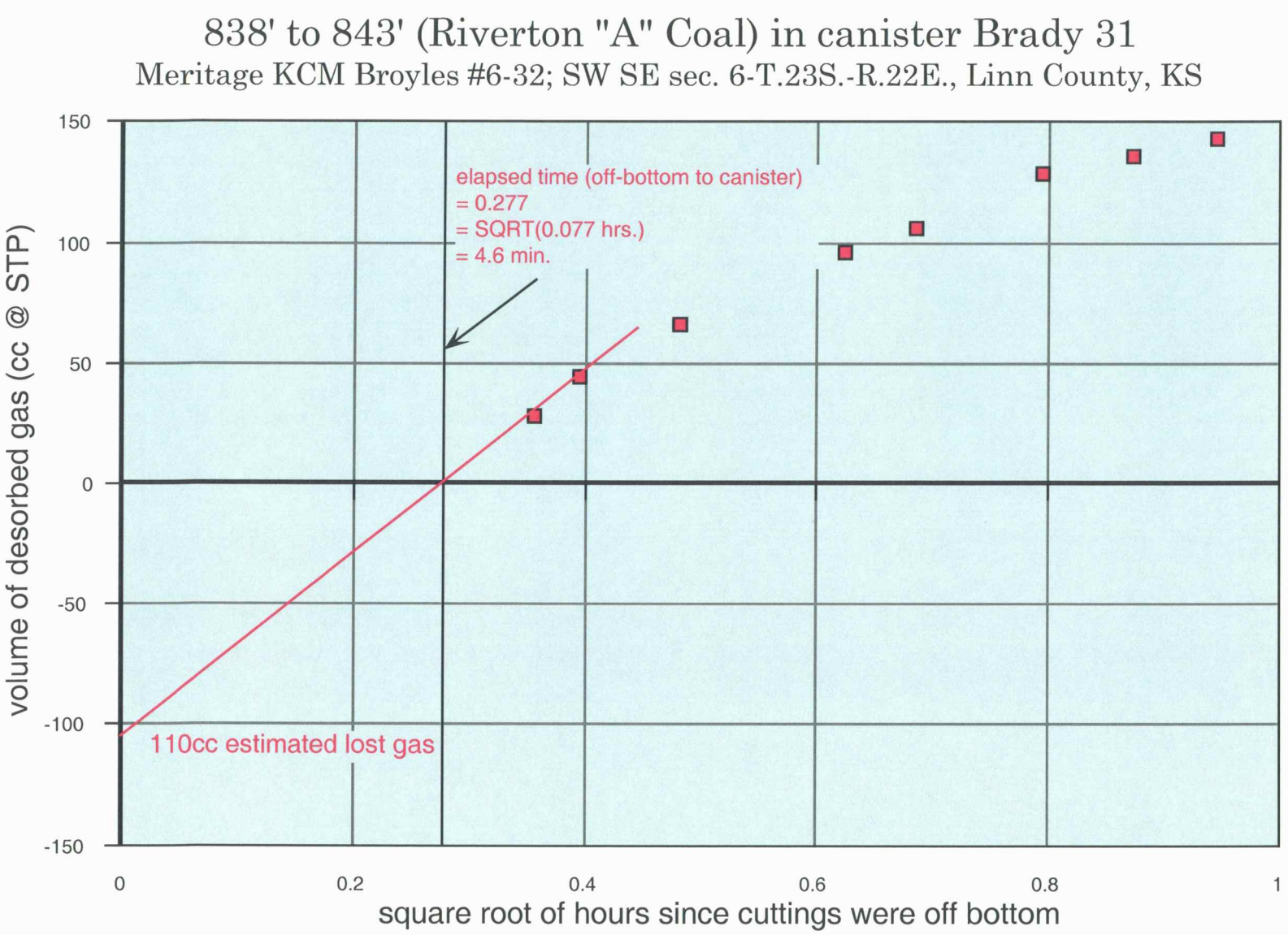
838' to 843' (Riverton "A" Coal) in canister Brady 31
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
150
100
50
0
-50
-100
-150
volume of desorbed gas (cc @ STP)
elapsed time (off-bottom to canister)
= 0.277
= SQRT(0.077 hrs.)
= 4.6 min.
110cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 8.

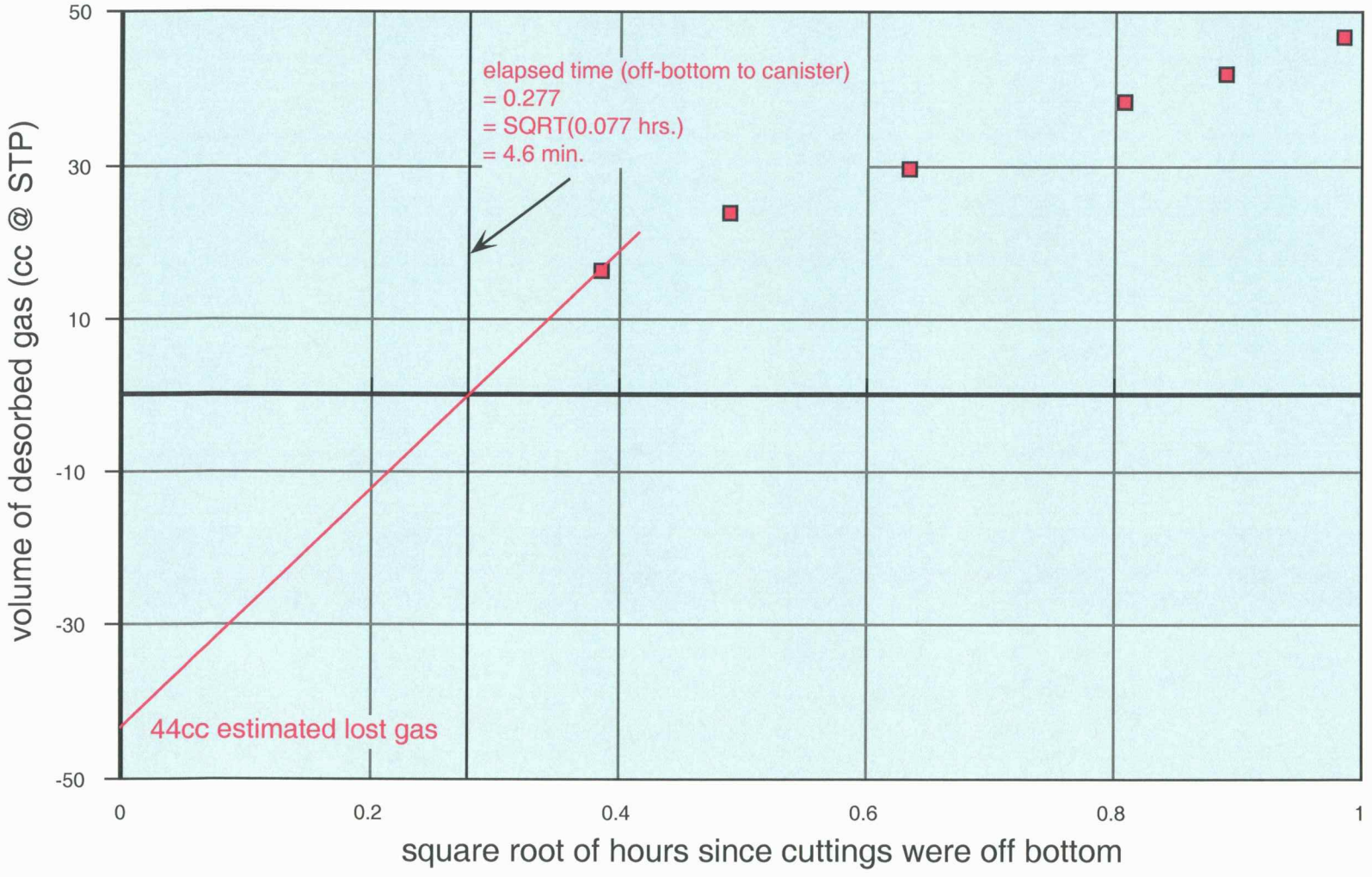
864' to 868' (Riverton "B" coal) in canister A
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
volume of desorbed gas (cc @ STP)
50
30
10
-10
-30
-50
elapsed time (off-bottom to canister)
= 0.277
= SQRT(0.077 hrs.)
= 4.6 min.
44cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 9.

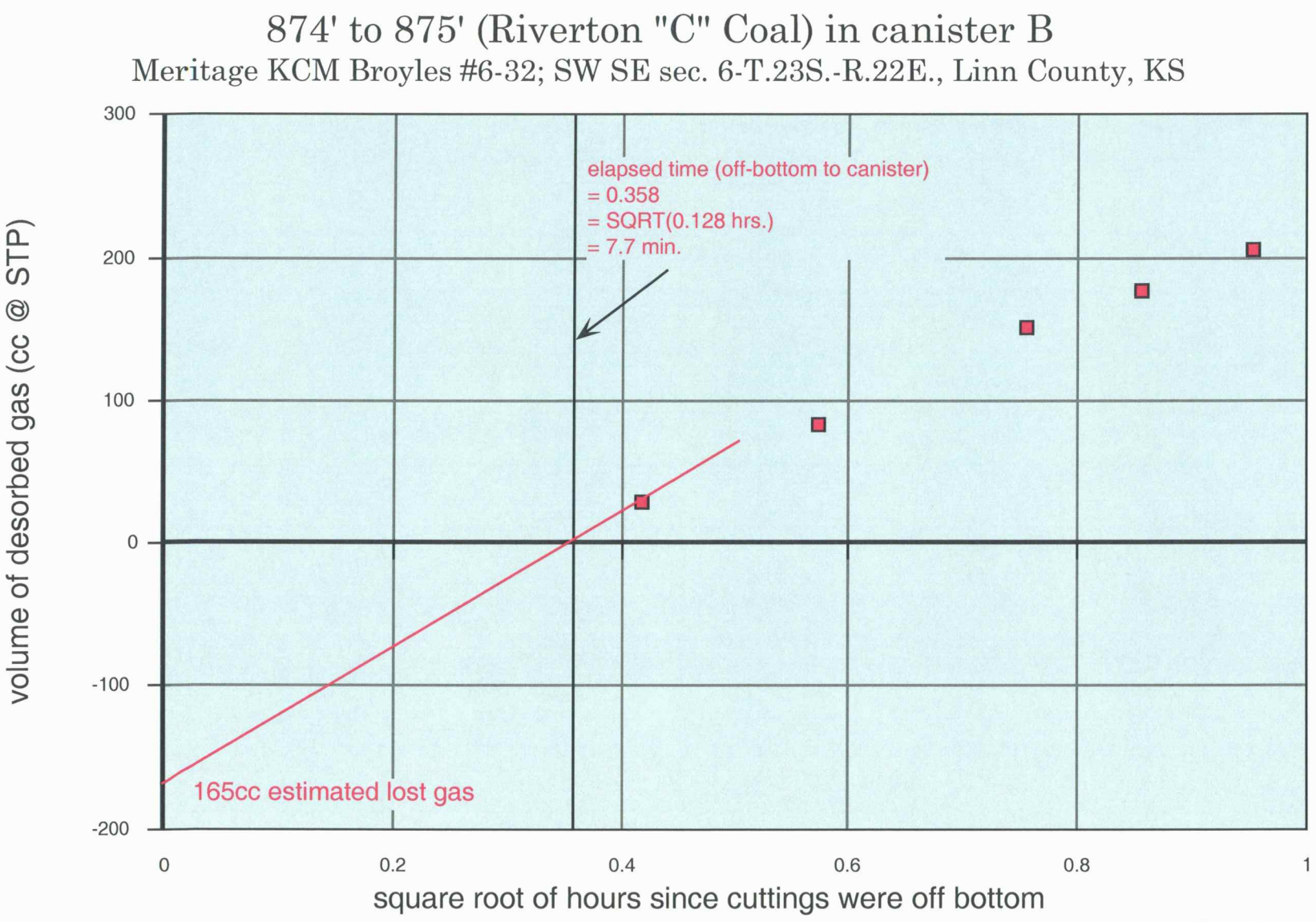
874' to 875' (Riverton "C" Coal) in canister B
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
volume of desorbed gas (cc @ STP)
300
200
100
0
-100
-200
elapsed time (off-bottom to canister)
= 0.358
= SQRT(0.128 hrs.)
= 7.7 min.
165cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 10.

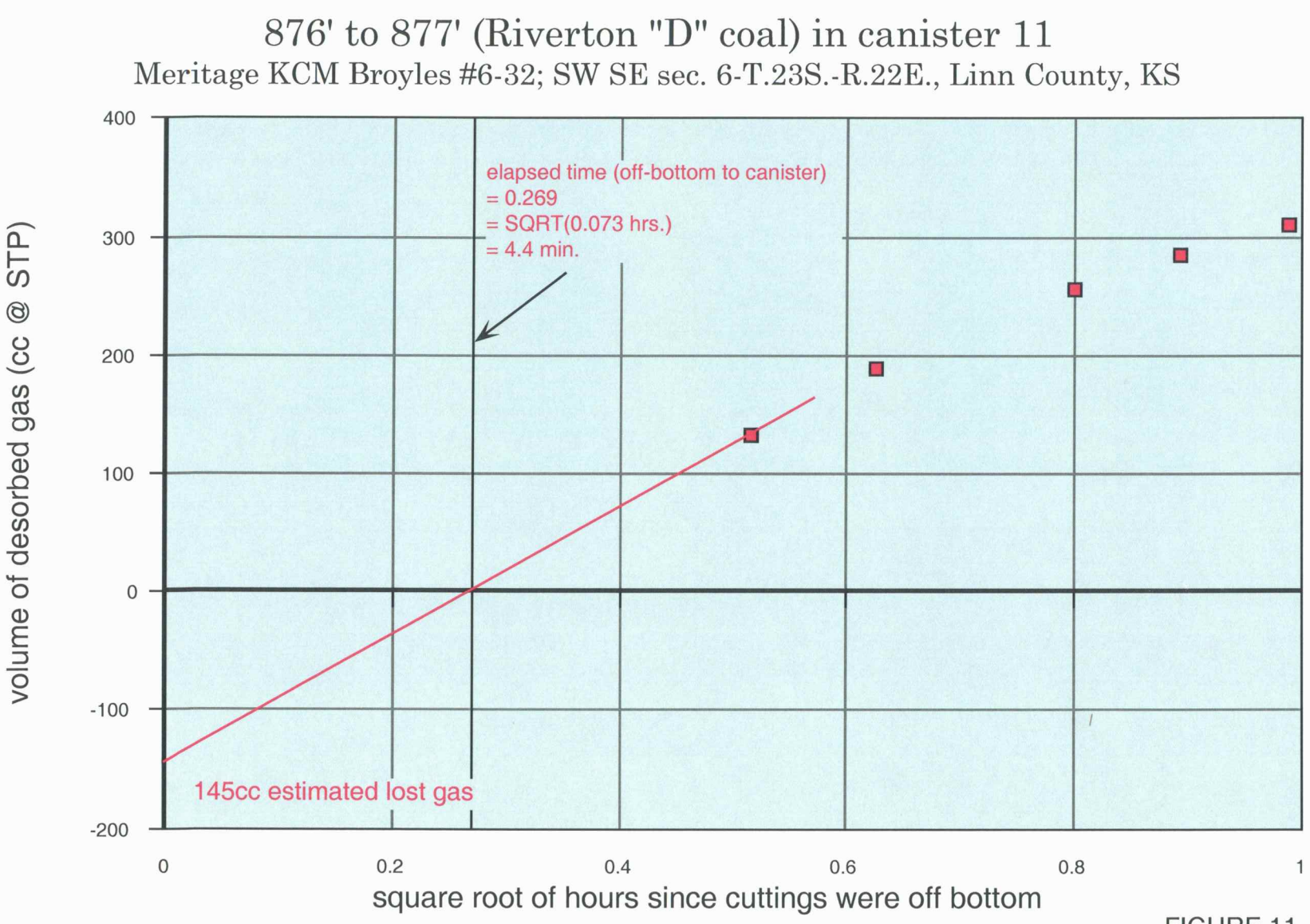
876' to 877' (Riverton "D" coal) in canister 11
Meritage KCM Broyles #6-32; SW SE sec. 6-T.23S.-R.22E., Linn County, KS
volume of desorbed gas (cc @ STP)
400
300
200
100
0
-100
-200
elapsed time (off-bottom to canister)
= 0.269
= SQRT(0.073 hrs.)
= 4.4 min.
145cc estimated lost gas
0
0.2
0.4
0.6
0.8
1
square root of hours since cuttings were off bottom

FIGURE 11.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mulky coal from 484-487'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 105 ccs

TOTAL DRY WEIGHT OF SAMPLE = 520.00 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 5.34 grams (1.0%)
$\text{weight}_{dark\ shale}$ = 462.77 grams (89.0%)
weight_{coal} = 51.89 grams (10.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	250.06	1.50% / 97.96% / 0.54%
>0.0661"	84.56	5.58% / 93.18% / 1.24%
>0.0460"	59.89	11.75% / 85.71% / 2.54%
>0.0331"	32.45	26.12% / 72.39% / 1.49%
<0.0331"	93.04	30.00% / 69.00% / 1.00%
	520.00 TOTAL	

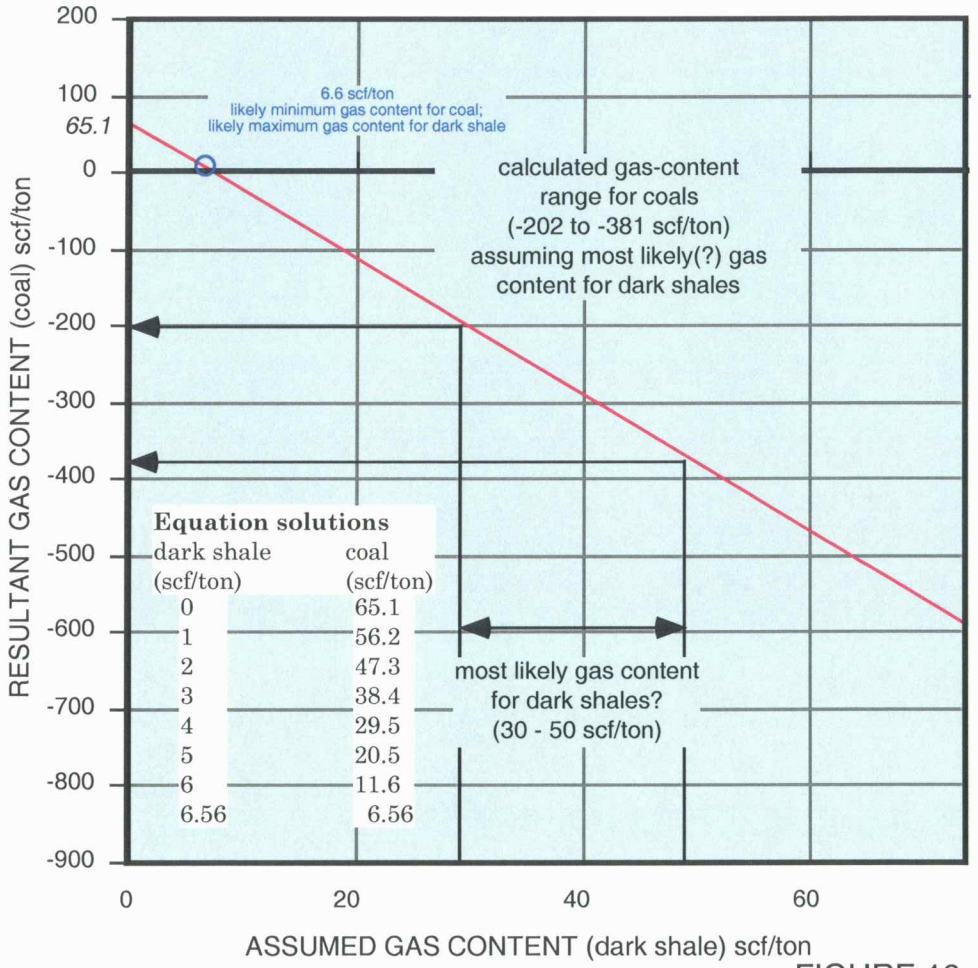

FIGURE 12.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Flemming coal from 606-607'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 601 ccs

TOTAL DRY WEIGHT OF SAMPLE = 920.86 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 7.94 grams (0.9%)
$\text{weight}_{dark\ shale}$ = 387.75 grams (42.1%)
weight_{coal} = 525.18 grams (57.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	496.88	38.58% / 60.94% / 0.48%
>0.0661"	164.46	72.93% / 26.23% / 0.85%
>0.0460"	119.26	83.98% / 13.81% / 2.21%
>0.0331"	58.61	93.00% / 6.00% / 1.00%
<0.0331"	81.65	72.12% / 26.74% / 1.13%
	920.86 TOTAL	

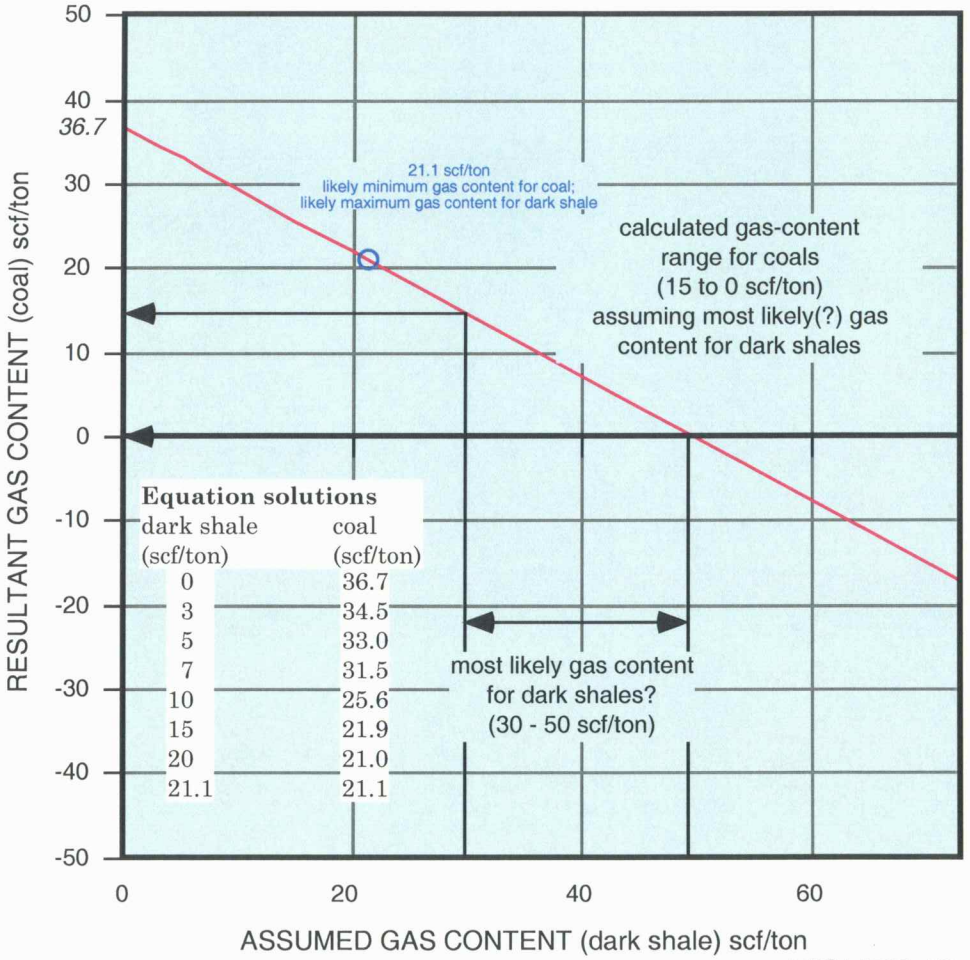

FIGURE 13.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Tebo coal from 647-649'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 217 ccs

TOTAL DRY WEIGHT OF SAMPLE = 718.32 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 4.13 grams (0.6%)
$\text{weight}_{dark\ shale}$ = 501.89 grams (69.9%)
weight_{coal} = 212.30 grams (29.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	289.93	16.86% / 82.66% / 0.48%
>0.0661"	139.75	33.15% / 66.21% / 0.64%
>0.0460"	97.40	34.53% / 64.86% / 0.62%
>0.0331"	46.78	39.46% / 59.46% / 1.08%
<0.0331"	144.46	45.00% / 54.50% / 0.50%
	718.32 TOTAL	

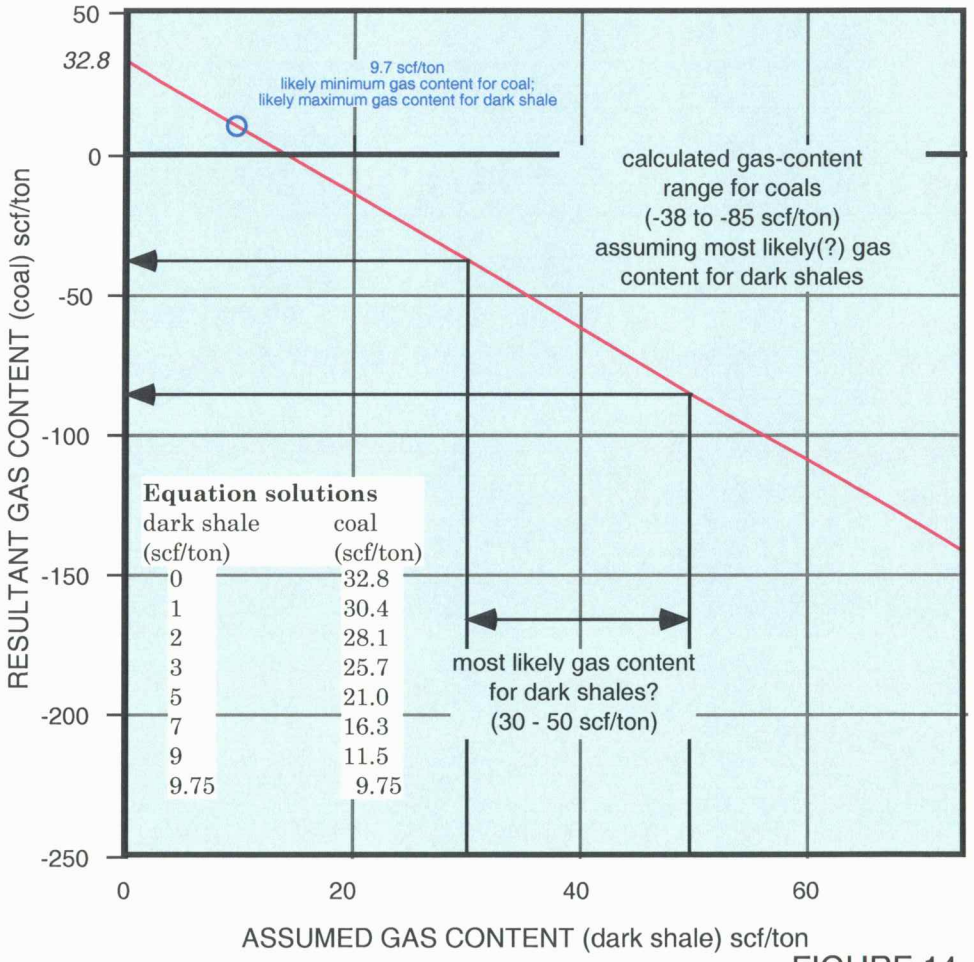

FIGURE 14.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Rowe coal from 798-800'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{\text{dark shale}}) * (\text{weight}_{\text{dark shale}}))}{\text{weight}_{coal}}$$

total gas desorbed = 1136 ccs

TOTAL DRY WEIGHT OF SAMPLE = 865.42 grams
$\text{weight}_{\text{light-colored lithologies}}$ = 29.00 grams (3.4%)
$\text{weight}_{\text{dark shale}}$ = 283.46 grams (32.8%)
weight_{coal} = 552.96 grams (63.9%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	399.59	48.45% / 50.50% / 1.05%
>0.0661"	127.77	77.64% / 18.13% / 4.23%
>0.0460"	95.20	83.64% / 11.15% / 5.20%
>0.0331'	63.04	79.86% / 11.11% / 9.03%
<0.0331"	179.82	72.40% / 22.72% / 4.88%
	865.42 TOTAL	

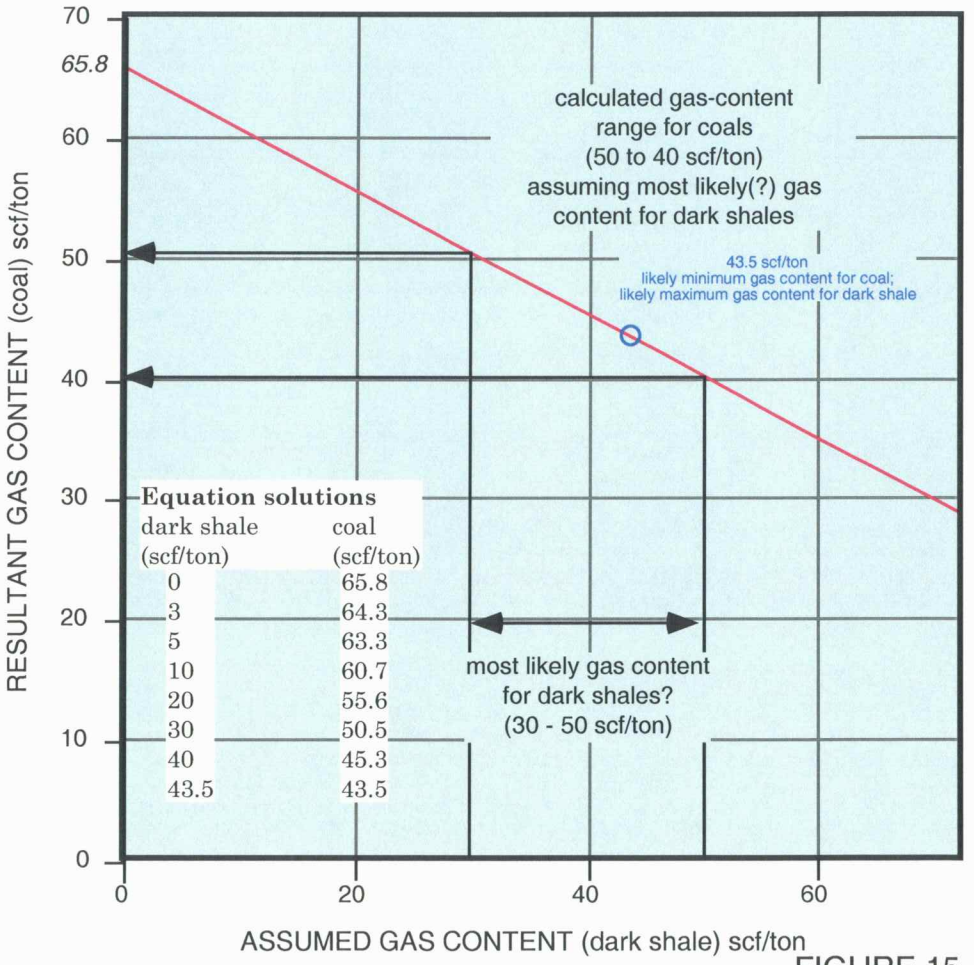

FIGURE 15.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of shale above Riverton coal at 820-822'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 66 ccs

TOTAL DRY WEIGHT OF SAMPLE = 679.50 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 0.00 grams (0.0%)
$\text{weight}_{dark\ shale}$ = 679.50 grams (100.0%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	393.28	0.00% / 100.00% / 0.00%
>0.0661"	126.66	0.00% / 100.00% / 0.00%
>0.0460"	70.53	0.00% / 100.00% / 0.00%
>0.0331"	25.79	0.00% / 100.00% / 0.00%
<0.0331"	63.24	0.00% / 100.00% / 0.00%
	679.50 TOTAL	

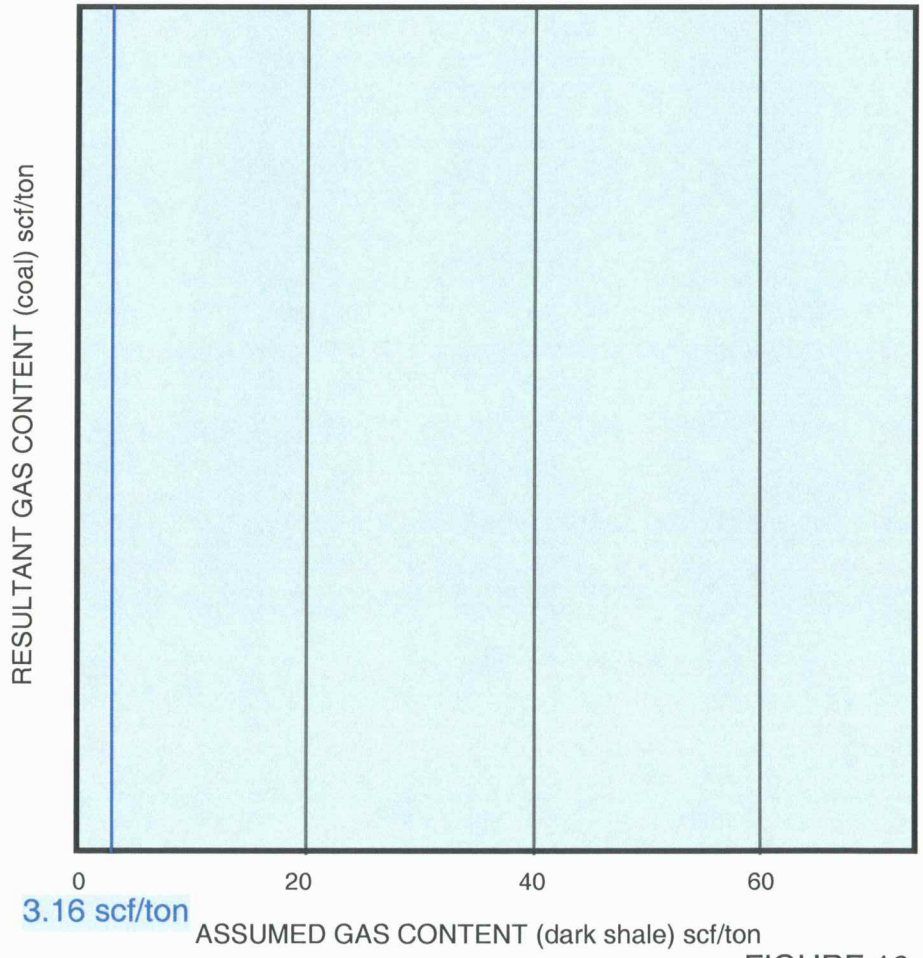

FIGURE 16.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton "A" coal from 838-843'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 945 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1230.93 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 116.69 grams (9.5%)
$\text{weight}_{dark\ shale}$ = 598.11 grams (48.6%)
weight_{coal} = 516.13 grams (41.9%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	578.18	26.57% / 67.84% / 5.59%
>0.0661"	183.05	53.15% / 33.22% / 13.64%
>0.0460"	126.47	61.51% / 24.61% / 13.88%
>0.0331"	77.19	65.04% / 21.14% / 13.82%
<0.0331"	266.05	51.57% / 36.70% / 11.73%
	1230.93 TOTAL	

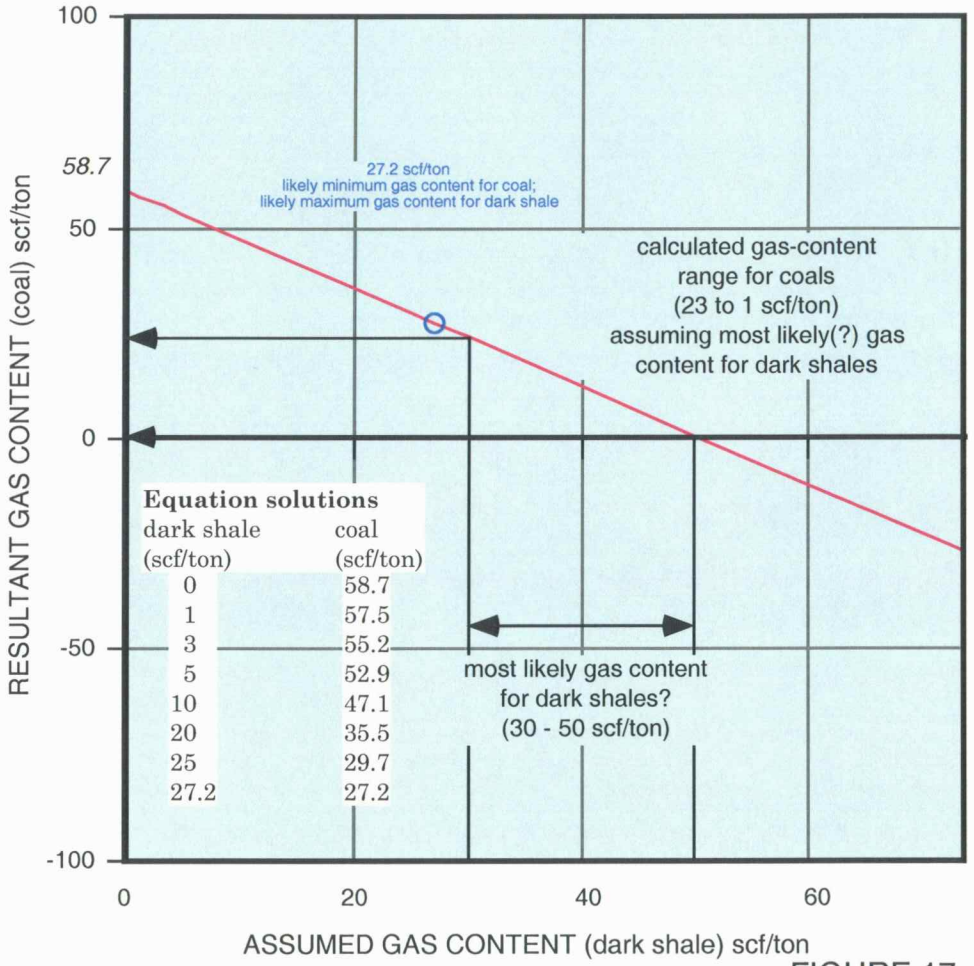

FIGURE 17.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton "B" coal from 864-868'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 254 ccs

TOTAL DRY WEIGHT OF SAMPLE = 736.02 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 26.15 grams (3.6%)
$\text{weight}_{dark\ shale}$ = 503.61 grams (68.4%)
weight_{coal} = 206.26 grams (28.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	387.93	12.96% / 84.77% / 2.27%
>0.0661"	105.87	46.91% / 46.91% / 6.18%
>0.0460"	86.78	48.17% / 48.17% / 3.66%
>0.0331"	51.05	47.10% / 47.10% / 5.79%
<0.0331"	104.38	38.78% / 38.78% / 4.88%
	736.02 TOTAL	

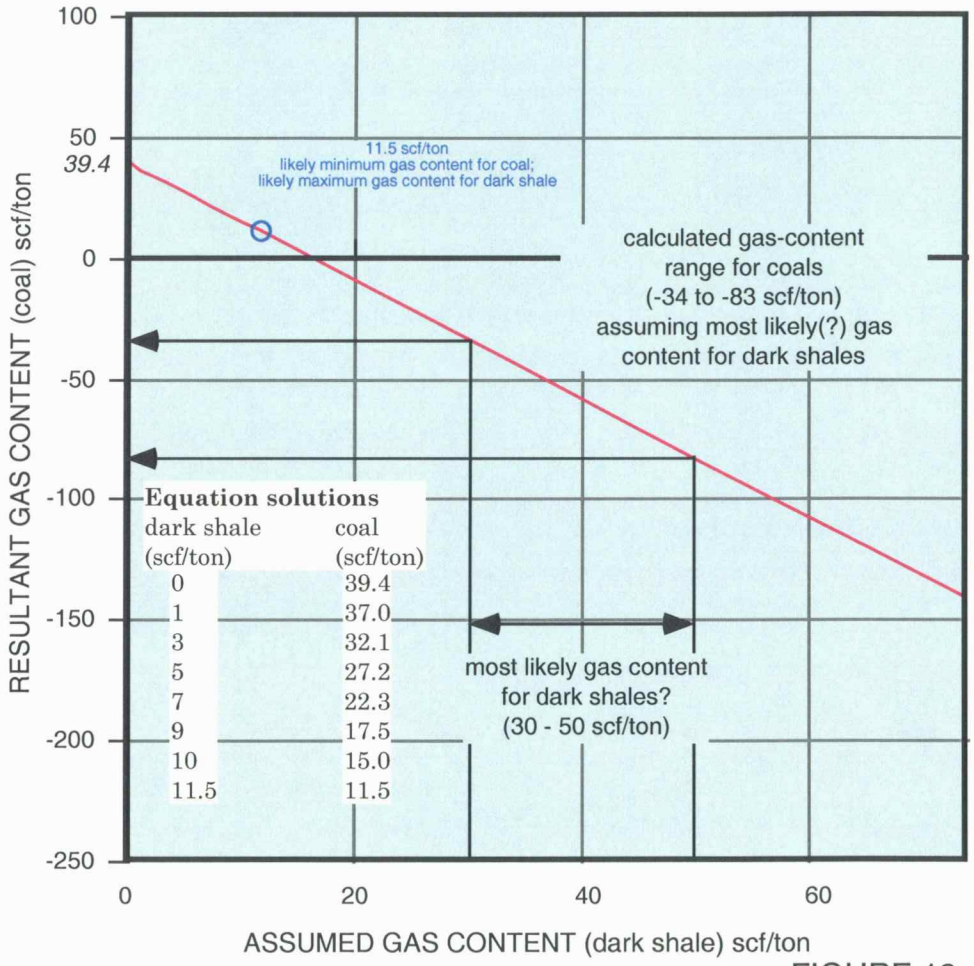

FIGURE 18.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton "C" coal from 874-875'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 2004 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1564.48 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 33.53 grams (2.1%)
$\text{weight}_{dark\ shale}$ = 182.83 grams (11.7%)
weight_{coal} = 1348.12 grams (86.2%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	496.87	86.00% / 10.99% / 3.01%
>0.0661"	264.13	88.20% / 10.67% / 1.12%
>0.0460"	237.94	89.45% / 9.82% / 0.73%
>0.0331"	159.21	79.43% / 17.14% / 3.43%
<0.0331"	406.34	85.77% / 12.16% / 2.07%
	1564.48 TOTAL	

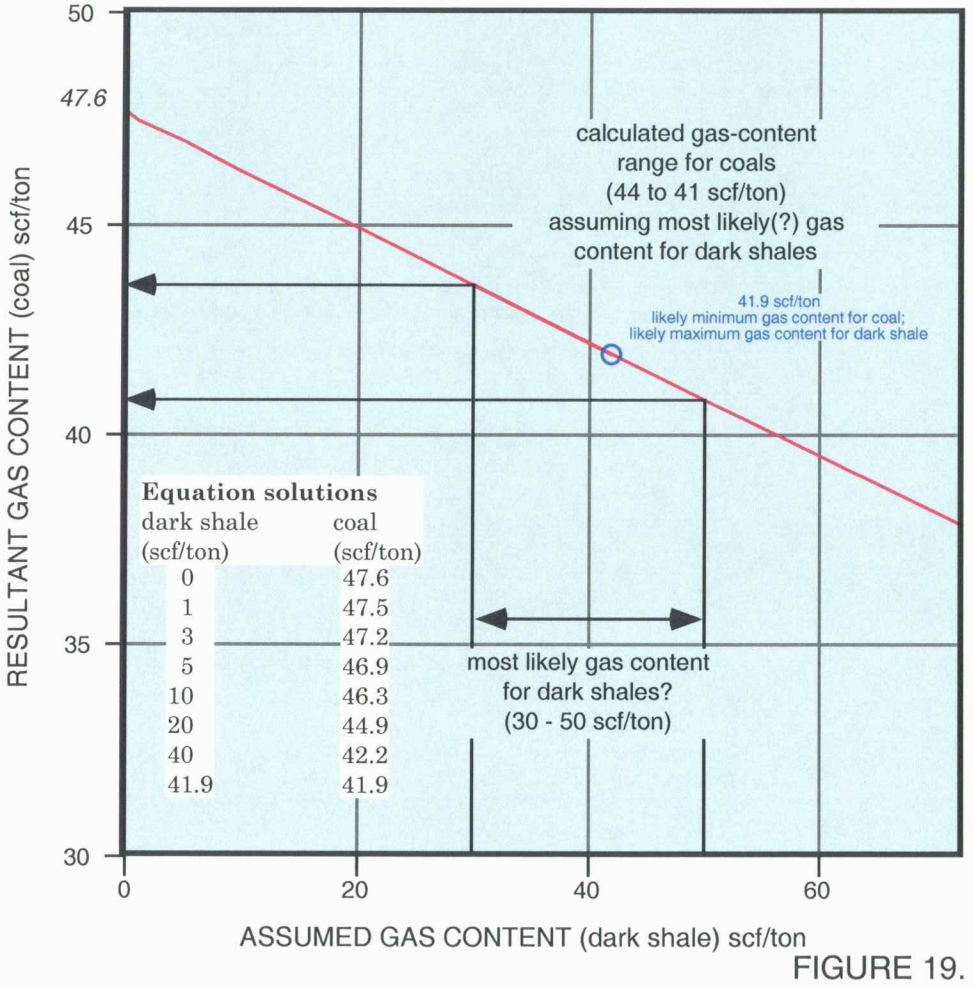

FIGURE 19.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton "D" coal from 874-875'

$$\text{GAS CONTENT}_{coal} = \frac{\text{total gas desorbed} - ((\text{gas content}_{dark\ shale}) * (\text{weight}_{dark\ shale}))}{\text{weight}_{coal}}$$

total gas desorbed = 2223 ccs

TOTAL DRY WEIGHT OF SAMPLE = 1629.10 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 130.56 grams (8.0%)
$\text{weight}_{dark\ shale}$ = 660.09 grams (40.5%)
weight_{coal} = 838.45 grams (51.5%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	874.75	38.46% / 49.88% / 11.66%
>0.0661"	276.54	62.79% / 35.32% / 1.49%
>0.0460"	197.07	70.29% / 25.60% / 4.11%
>0.0331"	124.58	75.11% / 19.00% / 5.88%
<0.0331"	156.15	61.66% / 32.55% / 5.78%
	1629.10 TOTAL	

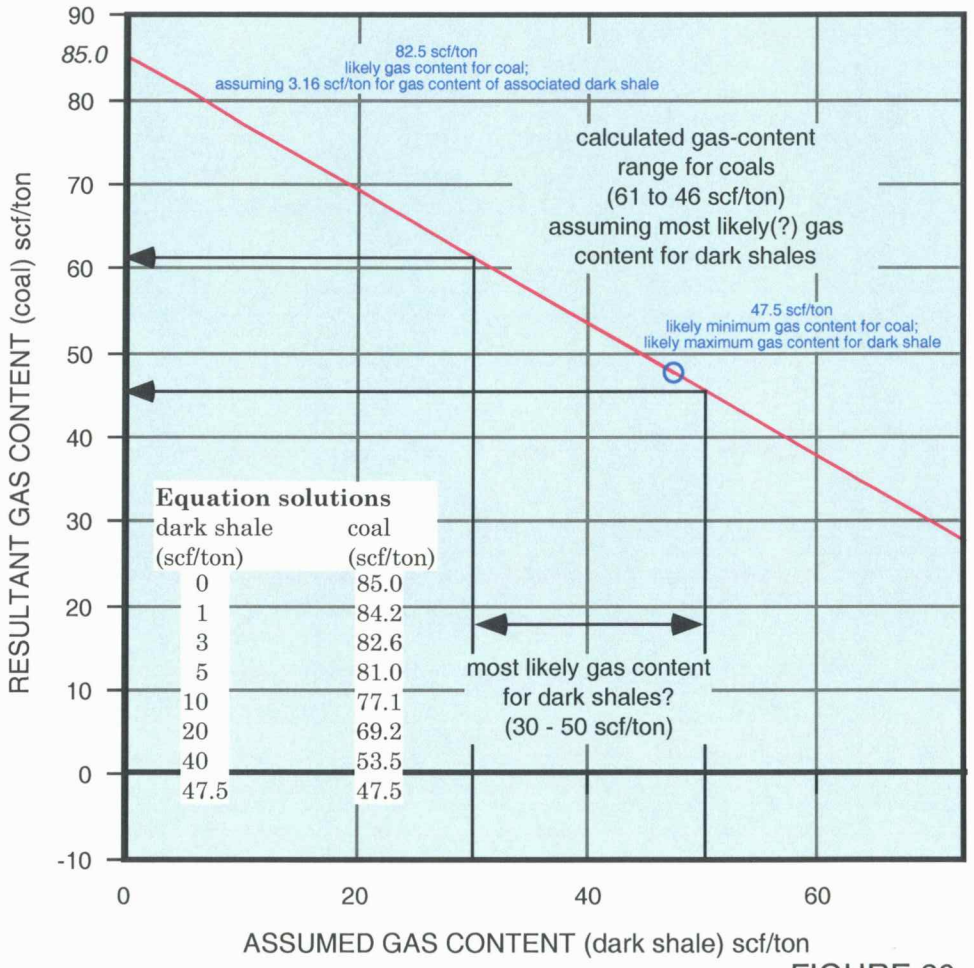

FIGURE 20.

Desorption Characteristics of Cuttings Samples

Meritage KCM #6-32 Broyles; sec. SW SE 6-T.23S.-R.22E.; Linn Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for all samples

surface

100'

200'

300'

400'

484'-487' Mulky

600'

606'-607' Flemming

647'-649' Tebo

700'

800'

798'-800' Rowe
820'-822' shale above Riverton
838'-843' Riverton "A"
864'-868' Riverton "B"
874'-875' Riverton "C"
876'-877' Riverton "D"

1000'

UNIT	coal in sample	scf/ton w/ shale @ 3 scf/ton	maximum scf/ton	minimum scf/ton
Mulky	10%	38.4	65.1	6.6
Flemming	57%	34.5	36.7	21.1
Tebo	30%	25.7	32.8	9.7
Rowe	64%	64.3	65.8	43.5
shale	0%	------	3.2	3.2
Riverton "A"	42%	55.2	58.7	27.2
Riverton "B"	28%	32.1	39.4	11.5
Riverton "C"	86%	47.2	47.6	41.9
Riverton "D"	52%	82.6	85.0	47.5

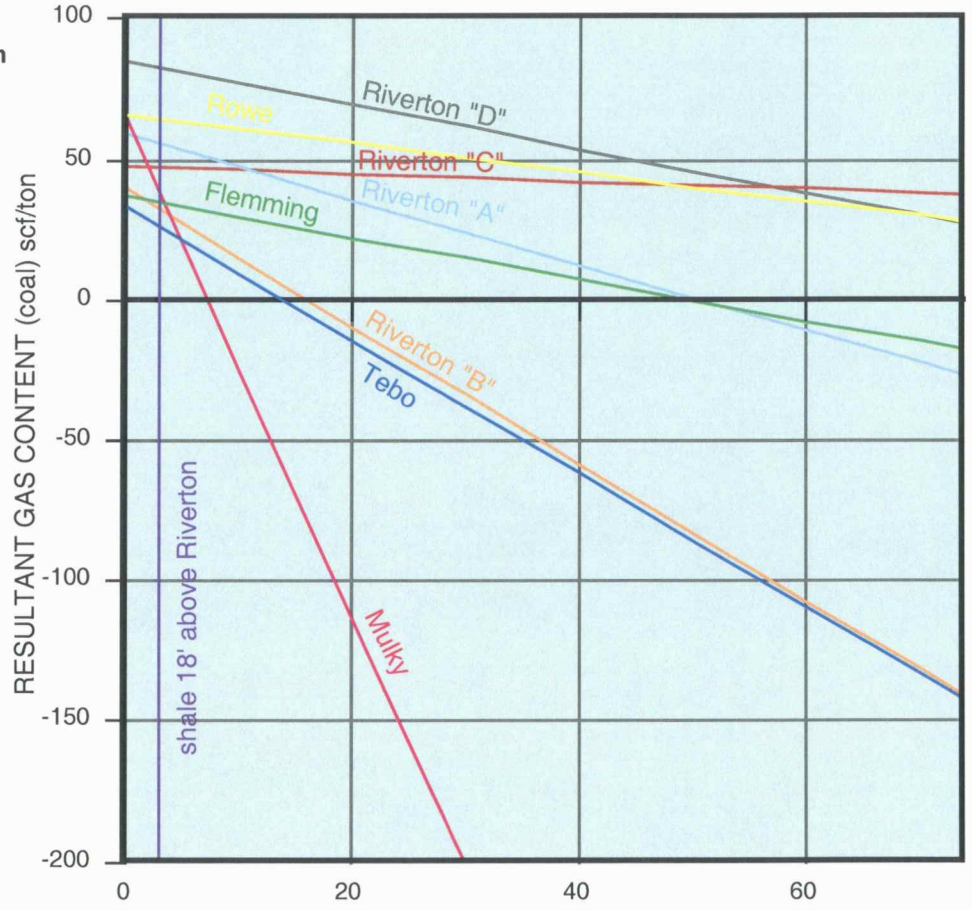

FIGURE 21.

Desorption Characteristics of Cuttings Samples (ie., coal & dark shale)

Meritage KCM #6-32 Broyles; SW SE sec. 6-T.23S.-R.22E., Linn County, KS

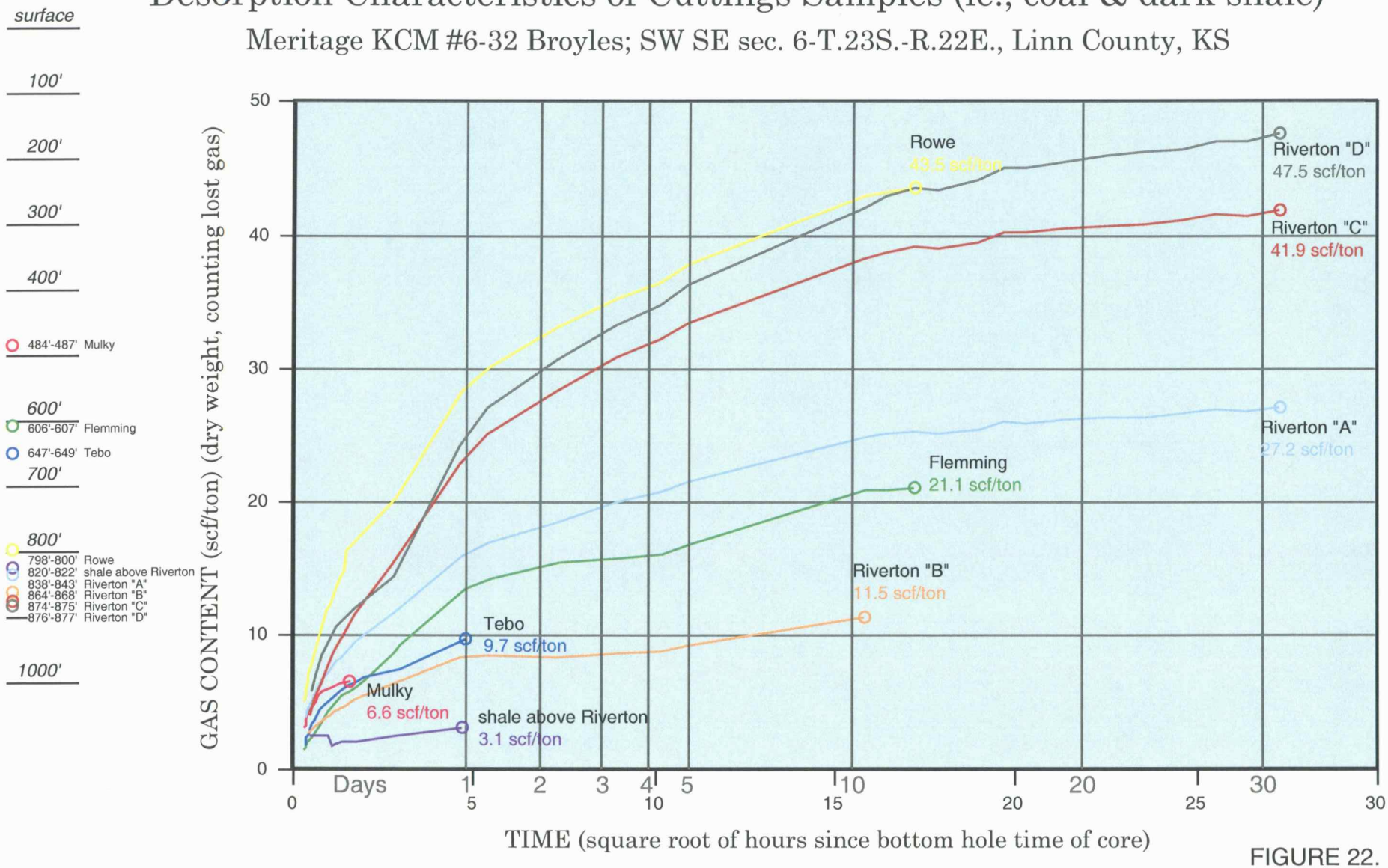

FIGURE 22.