ANALYSIS OF CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- BTA OIL PRODUCERS 20104 JV-P WALNUT #5 SWD (5-T.7S.-R.21E.), ATCHISON COUNTY, KANSAS

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SUMMARY

Five cuttings samples from the Pennsylvanian Cherokee Group were collected from the BTA Oil Producers 20104 JV-P Walnut #5 SWD well (622' FSL, 2154' FEL, 5-T.7S.-R.21E.) in Atchison County, KS. Assuming the dark shale that is usually admixed with the coal in the cuttings has approximately 3 scf/ton gas content, the coals calculate to have the following gas contents:

- Mineral coal at 1039' to 1041' depth (37 scf/ton)
- Krebs coal at 1260' to 1262' depth (248 scf/ton)*
- Rowe coal at 1340' to 1342' depth (29 scf/ton)
- Rowe coal at 1342' to 1345' depth (109 scf/ton)
- Riverton coal at 1406' to 1409' depth (87 scf/ton)

*reliability of result is unclear, due to small amount of coal in the sample

The most reliable result, which is largely controlled by the amount of coal in the cuttings, is from the Rowe coal sample from 1342' to 1345'. This sample registered 58% coal. The least-constrained results are from the Krebs coal sample, which had only 11% coal.

BACKGROUND

BTA Oil Producers 20104 JV-P Walnut #5 SWD well (622' FSL, 2154' FEL, 5-T.7S.-R.21E.) in Atchison 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 the evening of February 13, and the morning of February 14, 2003 by K. David Newell and Glen Gagnon of the Kansas Geological Survey, with well site collection aided by Steve Miller (consultant for BTA Oil Producers). 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 a mud rotary rig. Lag times for samples to reach the surface (important for assessing lost gas) were determined by calculation of pump capacity versus depth and hole diameter, in addition to noting the time delay between drilling breaks (through coals) and the response of a mud-system gas chromatograph.

Five cuttings samples were collected from the Pennsylvanian (Desmoinesian) Cherokee Group:

- Mineral coal at 1039' to 1041' depth (228.5 grams; 28% coal)
- Krebs coal at 1260' to 1262' depth (237.8 grams; 11% coal)
- Rowe coal at 1340' to 1342' depth (292.4 grams; 36% coal)
- Rowe coal at 1342' to 1345' depth (341.4 grams; 58% coal)
- Riverton coal at 1406' to 1409' depth (268.0 grams; 26% coal)

The cuttings samples were caught in a kitchen strainer at the entry pipe to the "possum belly" of the shale shaker. The samples were immediately washed in water in another kitchen strainer to rid them of drilling mud before they were placed in desorption canisters. A temperature bath for the desorption canisters was on site, with temperatures set at 70 degrees F for the Mineral coal sample and 75 degrees F for the deeper coals. The canistered samples were transported to the laboratory at the Kansas Geological Survey on the morning of February 14th, and desorption measurements were continued. 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 9, 10, 11, and B were obtained from SSD, Inc. in Grand Junction, CO. On average, these 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). Canister Mer B was obtained from PEL-I-CANS (by J.R. Levine) in Richardson, TX. On average, the canisters were approximately 11.2 inches high (28.5 cm), 3.8 inches (9.7 cm) in diameter, and enclosed a volume of approximately 127 cubic inches (2082 cm^3). For all samples, a concrete plug was placed in the desorption canister to decrease the volume of free space within the canister. This volume of this plug was 77 cubic inches (1262 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. The regression equation 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 the 20104 JV-P Walnut #5 SWD well, the maximum time of desorption was 5 1/2 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.

Due to the small samples size, an experimental correction was applied to compensate for the expansion and contraction of the free air space in the desorption canisters due to temperature and pressure changes between successive desorption measurements. For this correction, the free-air-space volume in each canister was calculated by subtracting the volume of the plug and volume of the sample from the interior volume of the empty canister. The calculated volume of the sample in the canister was derived from a density measurement on a portion of the sample after decanistering. This sample portion (approximately 50 grams) was selected after running the sample through a sample splitter. The theoretical expansion or contraction of this free gas volume was calculated using the atmospheric pressure and temperature changes between successive desorption measurements. The net change in volume (negative or positive) was converted to standard temperature and pressure, and then added to the volumetric measurement (also converted to standard temperature and pressure) for each desorption measurement. Depending on the changes in pressure and temperature during desorption, the resultant total gas desorbed for each sample ranged from -10.3% to 1.9% of the uncorrected total gas.

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 1)

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 (Tables 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 2-6)
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 7-11)
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:

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

A unique solution for $\textit{gas content}_{coal}$ in this equation is not possible because $\textit{gas content}_{dark\ shale}$ 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 12)
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 13)
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 Krebs coal sample registered the greatest gas content at 247.9 scf/ton (assuming the admixed dark shale produce 3 scf/ton), but this sample contained only 11% coal, hence the analysis carries some uncertainty. Conversely, the other four samples contained greater percentages of coal. The sample with the greatest percentage of coal is the Rowe sample from 1343'-1345', hence it has the least uncertainty is attached to its gas content.

The two Rowe samples (1340'-1342' and 1342'-1345') were paired samples, with the upper one targeting the shale above the Rowe, and the lower one targeting the coal itself. Both samples, however, had percentages of coal. With this sampling scheme, the linear equations expressing the gas content of the shale and the coal (the line expressed in the sensitivity diagrams) could be solved simultaneously, thereby giving a gas content for the coal and its associated the dark shale. The underlying assumption is that the black shale cuttings in both samples have nearly identical gas content. Similarly, if coal is present in both samples, the coal in one sample is implicitly assumed to have identical gas content to the coal in the other sample. Unfortunately, this sampling experiment did not have optimal results in that the linear solutions for both samples did not have a point of intersection. The reason for this is not understood with present data, but perhaps coal quality changes drastically within the Rowe coal, and this, in turn, affects gas content.

The value of 3 scf/ton for the dark shales used for calculating coal gas content is based on the assays of the gas content of dark shale samples in the Cherokee basin and Bourbon arch in eastern Kansas. A very high-gamma ray shale may carry more gas, but present data do not allow reasonable estimation of this gas content. Inasmuch as the BTA Oil Producers 20104 JV-P Walnut #5 SWD well is one of the first wells in the Forest City basin for which cutting were analyzed, the "rule of thumb" of 3 scf/ton for the associated black shale may be speculative. Additional analyses are needed to gain confidence in this assumption.

REFERENCES

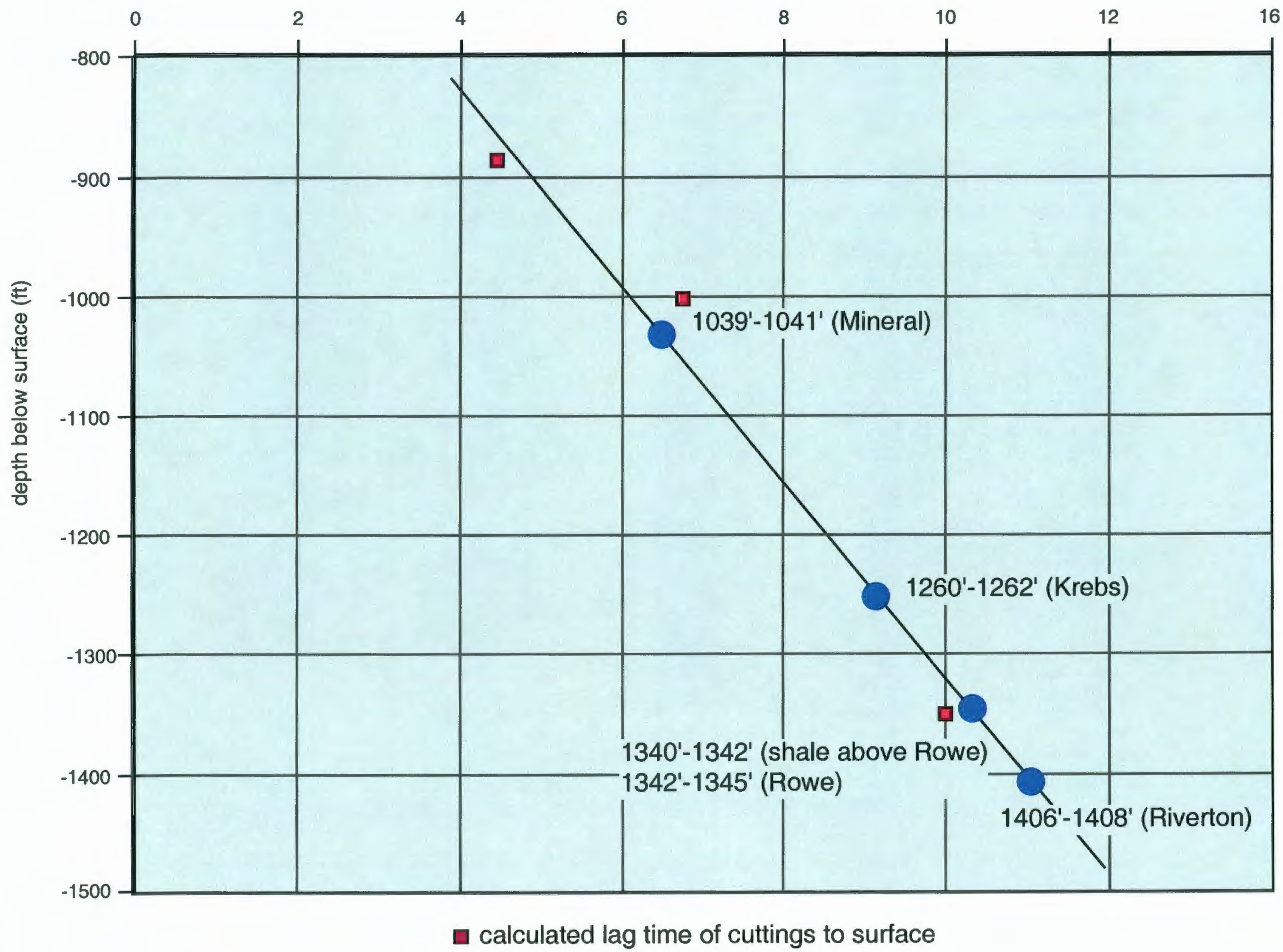
Dake, L.P., 1978, Fundamentals of Reservoir Engineering, Elsevier Scientific Publishing, New York, NY, 443 p.

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

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E., Atchison County, KS
lag-time to surface for well cuttings (in minutes)



BTA Oil Producers 20104 JV-P Walnut #5 SWD; 622' FSL, 2154' FEL, 5-T.7S.-R.21E.

SAMPLE: 1039' to 1041' (Mineral coal) in canister 9

DRY WEIGHT lbs. grams
sample weight: 0.3006 136.37

est. lost gas (cc) = 19

TIME OF: off bottom 2/13/03 16:41; at surface 2/13/03 16:47; in canister 2/13/03 16:52

elapsed time (off bottom to canistering): 10.5 minutes; 0.175 hours; 0.4183 SQRT (hrs)

free air space in canister 1142.40

RIG MEASUREMENTS | CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) | CUMULATIVE VOLUMES

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	air-space adjusted vol. (cc)	air-space adjusted vol. (cubic ft@STP)	air-space adjusted vol. (cc @STP)	air-space-adjusted cum. vol. (cubic ft@STP)	air-space-adjusted cum. vol. (cc@STP)	SCF/TON with lost gas	TIME OF MEASURE	TIME SINCE off bottom	TIME SINCE in canister	SQRT hrs. (since off bottom)
	70	1082	0	530	14.044												
4	70	1082	0.00014	530	14.044	0.000132	3.75	4.00	0.00013	3.75	0.000132	3.75	**5.34**	2/13/03 16:56	0:14:30	0:04:00	0.491596
1	70	1082	3.5E-05	530	14.044	3.31E-05	0.94	1.00	3.3E-05	0.94	0.000166	4.69	**5.56**	2/13/03 16:57	0:15:30	0:05:00	0.508265
4	70	1082	0.00014	530	14.044	0.000132	3.75	4.00	0.00013	3.75	0.000298	8.44	**6.45**	2/13/03 17:03	0:21:30	0:11:00	0.5986095
1.5	70	1082	5.3E-05	530	14.044	4.97E-05	1.41	1.50	5E-05	1.41	0.000348	9.84	**6.78**	2/13/03 17:07	0:26:00	0:15:30	0.6582806
2.5	70	1082	8.8E-05	530	14.044	8.28E-05	2.34	2.50	8.3E-05	2.34	0.00043	12.19	**7.33**	2/13/03 17:11	0:29:45	0:19:15	0.7041543
2	70	1082	7.1E-05	530	14.044	6.62E-05	1.87	2.00	6.6E-05	1.87	0.000497	14.06	**7.77**	2/13/03 17:15	0:34:15	0:23:45	0.7555351
5	70	1082	0.00018	530	14.044	0.000166	4.69	5.00	0.00017	4.69	0.000662	18.75	**8.87**	2/13/03 17:25	0:43:30	0:33:00	0.8514693
7	70	1081	0.00025	530	14.031	0.000232	6.56	5.94	0.0002	5.57	0.000859	24.31	**10.18**	2/13/03 17:48	1:07:00	0:56:30	1.0567245
6	70	1081	0.00021	530	14.031	0.000196	5.62	6.00	0.0002	5.62	0.001057	29.93	**11.50**	2/13/03 18:08	1:27:00	1:16:30	1.2041595
7	70	1081	0.00025	530	14.031	0.000232	6.56	7.00	0.00023	6.56	0.001289	36.49	**13.04**	2/13/03 18:16	1:35:20	1:24:50	1.2605114
1	70	1081	3.5E-05	530	14.031	3.31E-05	0.94	1.00	3.3E-05	0.94	0.001322	37.42	**13.26**	2/13/03 18:47	2:06:00	1:55:30	1.4491377
12	71	1079	0.00042	531	14.005	0.000395	11.20	7.72	0.00025	7.21	0.001578	44.63	**14.95**	2/13/03 21:04	4:22:30	4:12:00	2.0916501
7	71	1077	0.00025	531	13.979	0.00023	6.52	4.88	0.00016	4.54	0.001736	49.17	**16.02**	2/13/03 23:09	6:27:30	6:17:00	2.5413251
8	71	1075	0.00028	531	13.953	0.000263	7.44	5.87	0.00019	5.46	0.001929	54.63	**17.30**	2/14/03 0:57	8:16:00	8:05:30	2.8751812
-1	71	1074	-3.5E-05	531	13.940	-3.28E-05	-0.93	-2.06	-6.8E-05	-1.92	0.001862	52.72	**16.85**	2/14/03 2:38	9:56:30	9:46:00	3.1530409
9	68	1068	0.00032	528	13.862	0.000295	8.36	9.07	0.0003	8.43	0.002159	61.14	**18.83**	2/14/03 18:15	25:33:30	25:23:00	5.055525
-26	66	1083	-0.00092	526	14.057	-0.000868	-24.58	-5.91	-0.0002	-5.59	0.001962	55.55	**17.51**	2/17/03 14:28	93:46:30	93:36:00	9.6837493
-8	68	1084	-0.00021	528	14.070	-0.0002	-5.66	-9.29	-0.00031	-8.75	0.001653	46.80	**15.46**	2/18/03 18:37	121:55:30	121:45:00	11.041965
-9	68	1090	-0.00032	528	14.148	-0.000301	-8.53	-2.71	-9.1E-05	-2.57	0.001562	44.23	**14.85**	2/19/03 13:34	140:52:30	140:42:00	11.869077

DECANISTERED 2/20/03

SAMPLE: 1260' to 1262' (Krebs coal) in canister Mer B

DRY WEIGHT lbs. grams
sample weight: 0.1355 61.47

est. lost gas (cc) = 39

TIME OF: off bottom 2/13/03 21:09; 2/13/03 21:16; in canister 2/13/03 21:23

elapsed time (off bottom to canistering): 14.5 minutes; 0.242 hours; 0.4916 SQRT (hrs)

free air space in canister 709.10

RIG MEASUREMENTS | CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) | CUMULATIVE VOLUMES

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	air-space adjusted vol. (cc)	air-space adjusted vol. (cubic ft@STP)	air-space adjusted vol. (cc @STP)	air-space-adjusted cum. vol. (cubic ft@STP)	air-space-adjusted cum. vol. (cc@STP)	SCF/TON with lost gas	TIME OF MEASURE	TIME SINCE off bottom	TIME SINCE in canister	SQRT hrs. (since off bottom)
	74	1079	0	534	14.005												
1	74	1079	3.5E-05	534	14.005	3.28E-05	0.93	1.00	3.3E-05	0.93	3.28E-05	0.93	**20.81**	2/13/03 21:27	0:18:15	0:03:45	0.5515131
3.5	74	1079	0.00012	534	14.005	0.000115	3.25	3.50	0.00011	3.25	0.000147	4.17	**22.50**	2/13/03 21:29	0:20:30	0:06:00	0.5845226
1.5	74	1079	5.3E-05	534	14.005	4.91E-05	1.39	1.50	4.9E-05	1.39	0.000197	5.57	**23.23**	2/13/03 21:32	0:23:00	0:08:30	0.6191392
5	74	1079	0.00018	534	14.005	0.000164	4.64	5.00	0.00016	4.64	0.00036	10.21	**25.64**	2/13/03 21:36	0:27:30	0:13:00	0.6770032
4	75	1079	0.00014	535	14.005	0.000131	3.70	2.87	8.7E-05	2.47	0.000448	12.68	**26.93**	2/13/03 21:40	0:31:15	0:16:45	0.7216878
4	75	1079	0.00014	535	14.005	0.000131	3.70	4.00	0.00013	3.70	0.000579	16.38	**28.86**	2/13/03 21:44	0:35:15	0:20:45	0.7664855
3.5	75	1079	0.00012	535	14.005	0.000114	3.24	3.50	0.00011	3.24	0.000693	19.62	**30.55**	2/13/03 21:47	0:38:15	0:23:45	0.798436
5.5	75	1079	0.00019	535	14.005	0.00018	5.09	5.50	0.00018	5.09	0.000873	24.72	**33.21**	2/13/03 21:53	0:44:00	0:29:30	0.8563488
7	75	1079	0.00025	535	14.005	0.000229	6.48	7.00	0.00023	6.48	0.001102	31.20	**36.59**	2/13/03 21:59	0:50:30	0:36:00	0.9174239
5	75	1079	0.00018	535	14.005	0.000164	4.63	5.00	0.00016	4.63	0.001265	35.83	**39.00**	2/13/03 22:05	0:56:30	0:42:00	0.9703951
3	75	1079	0.00011	535	14.005	9.81E-05	2.78	3.00	9.8E-05	2.78	0.001363	38.61	**40.45**	2/13/03 22:09	1:00:00	0:45:30	1
2	75	1079	7.1E-05	535	14.005	6.54E-05	1.85	2.00	6.5E-05	1.85	0.001429	40.46	**41.41**	2/13/03 22:12	1:03:30	0:49:00	1.0287533
5	75	1076	0.00018	535	13.992	0.000163	4.63	4.34	0.00014	4.02	0.001571	44.48	**43.51**	2/13/03 22:17	1:08:15	0:53:45	1.0665365

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	air-space adjusted vol. (cc)	air-space adjusted vol. (cubic ft@STP)	air-space adjusted vol. (cc @STP)	air-space-adjusted cum. vol. (cubic ft@STP)	air-space-adjusted cum. vol. (cc@STP)	SCF/TON with lost gas	TIME OF MEASURE		TIME SINCE off bottom	TIME SINCE in canister	SQRT hrs. (since off bottom)
5	75	1078	0.00018	535	13.992	0.000163	4.83	5.00	0.00016	4.83	0.001734	49.10	**45.92**	2/13/03	22:23	1:14:15	0:59:45	1.1124298
4	75	1078	0.00014	535	13.992	0.000131	3.70	4.00	0.00013	3.70	0.001865	52.80	**47.85**	2/13/03	22:30	1:21:15	1:08:45	1.1636867
5	75	1078	0.00018	535	13.992	0.000163	4.83	5.00	0.00016	4.83	0.002028	57.43	**50.26**	2/13/03	22:37	1:28:15	1:13:45	1.2127792
3	75	1078	0.00011	535	13.992	9.8E-05	2.78	3.00	9.8E-05	2.78	0.002126	60.20	**51.70**	2/13/03	22:42	1:33:00	1:18:30	1.24499
7	75	1078	0.00025	535	13.992	0.000229	6.48	7.00	0.00023	6.48	0.002355	66.88	**55.08**	2/13/03	22:54	1:45:00	1:30:30	1.3228757
6	75	1077	0.00021	535	13.979	0.000196	5.55	5.34	0.00017	4.94	0.002529	71.62	**57.65**	2/13/03	23:07	1:57:45	1:43:15	1.4008926
36	75	1075	0.00127	535	13.953	0.001173	33.21	34.88	0.00113	32.00	0.003859	103.81	**74.33**	2/14/03	0:59	3:49:45	3:35:15	1.9566257
30	75	1074	0.00106	535	13.940	0.000977	27.65	29.34	0.00096	27.04	0.004814	130.88	**88.42**	2/14/03	2:36	5:26:45	5:12:15	2.3338309
47	75	1068	0.00166	535	13.862	0.001521	43.08	43.02	0.00139	39.43	0.008006	170.08	**108.97**	2/14/03	18:18	21:08:45	20:54:15	4.5984599
-7	75	1083	-0.00025	535	14.057	-0.00023	-8.51	2.82	9.3E-05	2.62	0.006099	172.71	**110.34**	2/17/03	2:30	77:20:45	77:06:15	8.794648
-8	75	1084	-0.00021	535	14.070	-0.000197	-5.58	-5.35	-0.00018	-4.97	0.005923	187.73	**107.75**	2/18/03	18:38	117:28:45	117:14:15	10.838781
-10	75	1090	-0.00035	535	14.148	-0.00033	-9.35	-6.10	-0.0002	-5.70	0.005722	182.03	**104.77**	2/19/03	13:36	138:26:45	138:12:15	11.881003

DECANISTERED 2/20/03

SAMPLE: 1340' to 1342' (shale above Rowe coal) in canister 11

DRY WEIGHT lbs. grams
sample weight: 0.3385 153.55

est. lost gas (cc) = **47**

TIME OF: off bottom 2/13/03 23:41; in canister 2/14/03 0:04
2/13/03 23:52 elapsed time (off bottom to canistering) 22.3 minutes
0.371 hours
0.6090 SQRT (hrs)

free air space in canister
1113.20

RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	air-space adjusted vol. (cc)	air-space adjusted vol. (cubic ft@STP)	air-space adjusted vol. (cc @STP)	air-space-adjusted cum. vol. (cubic ft@STP)	air-space-adjusted cum. vol. (cc@STP)	SCF/TON with lost gas	TIME OF MEASURE		TIME SINCE off bottom	TIME SINCE in canister	SQRT hrs. (since off bottom)
	75	1076	0	535	13.966	0	0.00											
16	75	1076	0.00057	535	13.968	0.000522	14.77	18.00	0.00052	14.77	0.000522	14.77	**12.89**	2/14/03	0:10	0:28:15	0:06:00	0.686173
2	75	1076	7.1E-05	535	13.968	6.52E-05	1.85	2.00	6.5E-05	1.85	0.000587	16.62	**13.27**	2/14/03	0:11	0:30:00	0:07:45	0.7071068
3	75	1076	0.00011	535	13.966	9.78E-05	2.77	3.00	9.8E-05	2.77	0.000685	19.39	**13.85**	2/14/03	0:16	0:34:30	0:12:15	0.7582875
1	75	1076	3.5E-05	535	13.966	3.26E-05	0.92	1.00	3.3E-05	0.92	0.000717	20.32	**14.04**	2/14/03	0:18	0:36:45	0:14:30	0.7826238
5	75	1078	0.00018	535	13.986	0.000163	4.62	5.00	0.00016	4.62	0.00088	24.93	**15.01**	2/14/03	0:29	0:47:15	0:25:00	0.887412
4	75	1075	0.00014	535	13.953	0.00013	3.69	2.96	9.7E-05	2.73	0.000977	27.67	**15.58**	2/14/03	0:36	0:55:00	0:32:45	0.9574271
5	75	1075	0.00018	535	13.953	0.000163	4.81	5.00	0.00018	4.61	0.00114	32.28	**16.54**	2/14/03	0:46	1:05:00	0:42:45	1.040833
2	75	1075	7.1E-05	535	13.953	6.52E-05	1.85	2.00	6.5E-05	1.85	0.001205	34.13	**18.93**	2/14/03	0:52	1:10:30	0:48:15	1.0839742
15	75	1074	0.00053	535	13.940	0.000488	13.83	13.96	0.00045	12.87	0.00188	47.00	**19.61**	2/14/03	2:35	2:53:15	2:31:00	1.6992645
14	75	1068	0.00049	535	13.862	0.000453	12.83	7.75	0.00025	7.10	0.00191	54.10	**21.09**	2/14/03	18:18	18:36:15	18:14:00	4.3132548
-42	75	1083	-0.00148	535	14.057	-0.001379	-39.04	-26.58	-0.00087	-24.71	0.001038	29.39	**15.94**	2/17/03	14:30	86:48:15	88:26:00	9.3168754
-35	75	1084	-0.00124	535	14.070	-0.00115	-32.58	-33.97	-0.00112	-31.81	-7.8E-05	-2.22	**9.34**	2/18/03	18:37	114:55:15	114:33:00	10.720113
-17	75	1090	-0.0006	535	14.148	-0.000582	-15.90	-10.87	-0.00036	-10.17	-0.00044	-12.39	**7.22**	2/19/03	13:39	133:57:15	133:35:00	11.573857

DECANISTERED 2/20/03

SAMPLE: 1342' to 1345' (Rowe coal) in canister B

DRY WEIGHT lbs. grams
sample weight: 0.5646 256.11

est. lost gas (cc) = **133**

TIME OF: off bottom 2/13/03 23:46; in canister 2/14/03 0:03
2/13/03 23:58 elapsed time (off bottom to canistering) 17.0 minutes
0.283 hours
0.5323 SQRT (hrs)

free air space in canister
1030.60

RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft; @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	air-space adjusted vol. (cc)	air-space adjusted vol. (cubic ft@STP)	air-space adjusted vol. (cc @STP)	air-space-adjusted cum. vol. (cubic ft@STP)	air-space-adjusted cum. vol. (cc@STP)	SCF/TON with lost gas	TIME OF MEASURE		TIME SINCE off bottom	TIME SINCE in canister	SQRT hrs. (since off bottom)
	75	1078	0	535	13.988	0	0.00											
8	75	1078	0.00028	535	13.966	0.000261	7.39	8.00	0.00026	7.39	0.000261	7.39	**17.56**	2/14/03	0:05	0:19:30	0:02:30	0.5700877
4	75	1076	0.00014	535	13.968	0.00013	3.69	4.00	0.00013	3.69	0.000391	11.08	**18.02**	2/14/03	0:06	0:20:30	0:03:30	0.5845226
4	75	1078	0.00014	535	13.968	0.00013	3.69	4.00	0.00013	3.69	0.000522	14.77	**18.49**	2/14/03	0:08	0:22:00	0:05:00	0.6055301
4	75	1078	0.00014	535	13.966	0.00013	3.69	4.00	0.00013	3.69	0.000652	18.47	**18.95**	2/14/03	0:09	0:22:45	0:05:45	0.6157851
12	75	1078	0.00042	535	13.968	0.000391	11.08	12.00	0.00039	11.08	0.001044	29.55	**20.33**	2/14/03	0:13	0:26:45	0:09:45	0.6877075
5	75	1078	0.00018	535	13.968	0.000163	4.82	5.00	0.00016	4.82	0.001207	34.17	**20.91**	2/14/03	0:14	0:28:30	0:11:30	0.6892024
2	75	1076	7.1E-05	535	13.966	6.52E-05	1.85	2.00	6.5E-05	1.85	0.001272	36.01	**21.14**	2/14/03	0:15	0:28:45	0:11:45	0.8922187

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	air-space adjusted vol. (cc)	air-space adjusted vol. (cubic ft@STP)	air-space adjusted vol. (cc @STP)	air-space-adjusted cum. vol. (cubic ft@STP)	air-space-adjusted cum. vol. (cc@STP)	SCF/TON with lost gas	TIME OF MEASURE		TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
14	75	1078	0.00049	535	13.986	0.000457	12.93	14.00	0.00046	12.93	0.001728	48.94	**22.76**	2/14/03	0:19	0:33:00	0:18:00	0.7418198
6	75	1078	0.00021	535	13.986	0.000198	5.54	6.00	0.0002	5.54	0.001924	54.48	**23.45**	2/14/03	0:21	0:35:00	0:18:00	0.7637828
8	75	1078	0.00028	535	13.966	0.000281	7.39	8.00	0.00028	7.39	0.002185	61.87	**24.38**	2/14/03	0:23	0:37:30	0:20:30	0.7905694
11	75	1078	0.00039	535	13.966	0.000359	10.18	11.00	0.00036	10.18	0.002544	72.03	**25.65**	2/14/03	0:28	0:41:45	0:24:45	0.8341663
14	75	1078	0.00049	535	13.966	0.000457	12.93	14.00	0.00046	12.93	0.003	84.98	**27.26**	2/14/03	0:32	0:48:15	0:29:15	0.8779711
7	75	1076	0.00025	535	13.986	0.000228	6.46	7.00	0.00023	6.46	0.003228	91.42	**28.07**	2/14/03	0:35	0:49:15	0:32:15	0.9059985
15	75	1075	0.00053	535	13.953	0.000489	13.84	14.04	0.00046	12.95	0.003688	104.37	**29.69**	2/14/03	0:41	0:55:30	0:38:30	0.9817692
9	75	1075	0.00032	535	13.953	0.000293	8.30	9.00	0.00029	8.30	0.003979	112.68	**30.73**	2/14/03	0:45	0:59:15	0:42:15	0.9937303
19	75	1075	0.00067	535	13.953	0.000619	17.53	19.00	0.00062	17.53	0.004598	130.21	**32.92**	2/14/03	0:53	1:07:30	0:50:30	1.0606602
141	75	1074	0.00498	535	13.940	0.00459	129.96	140.04	0.00456	129.08	0.009157	259.28	**49.07**	2/14/03	2:33	2:48:45	2:29:45	1.6870833
226	75	1068	0.00798	535	13.882	0.007315	207.14	220.21	0.00713	201.84	0.016284	461.12	**74.32**	2/14/03	16:19	16:32:45	16:15:45	4.3064874
67	75	1083	0.00237	535	14.057	0.002199	62.27	81.27	0.00287	75.54	0.018952	536.66	**83.77**	2/17/03	14:30	86:43:45	86:26:45	9.3128495
8	75	1084	0.00028	535	14.070	0.000263	7.44	8.95	0.00029	8.33	0.019246	544.99	**84.81**	2/18/03	16:40	114:53:45	114:36:45	10.718947
-6	75	1090	-0.00021	535	14.148	-0.000198	-5.61	-0.33	-1.1E-05	-0.31	0.019235	544.88	**84.77**	2/19/03	13:37	133:50:45	133:33:45	11.569176
1	75	1084	3.5E-05	535	14.070	3.29E-05	0.93	-4.70	-0.00015	-4.38	0.019081	540.30	**84.22**	2/20/03	16:31	160:44:45	160:27:45	12.678558
-18	75	1090	-0.00084	535	14.148	-0.000595	-16.84	-12.33	-0.00041	-11.53	0.018674	528.77	**82.78**	2/23/03	22:25	238:38:45	238:21:45	15.448166
-15	75	1100	-0.00053	535	14.278	-0.0005	-14.16	-5.83	-0.00019	-5.32	0.018488	523.46	**82.12**	2/24/03	14:12	254:25:45	254:08:45	15.950838
11	75	1084	0.00039	535	14.070	0.000361	10.23	-4.21	-0.00014	-3.92	0.018347	519.54	**81.83**	2/26/03	15:42	303:55:45	303:38:45	17.433584
1	75	1083	3.5E-05	535	14.057	3.28E-05	0.93	0.05	1.8E-06	0.04	0.018349	519.58	**81.63**	2/27/03	18:47	331:00:45	330:43:45	18.193749

DECANISTERED 2/28/03

SAMPLE: 1406' to 1409' (Riverton coal) in canister 10

DRY WEIGHT	lbs.	grams
sample weight:	0.2511	113.91

est. lost gas (cc) = **40**

TIME OF: 2/14/03 1:17 elapsed time (off bottom to canistering)

off bottom		in canister		
2/14/03	1:08	2/14/03	1:27	21.0 minutes
				0.350 hours
				0.5916 SQRT (hrs)

free air space in canister
1124.20

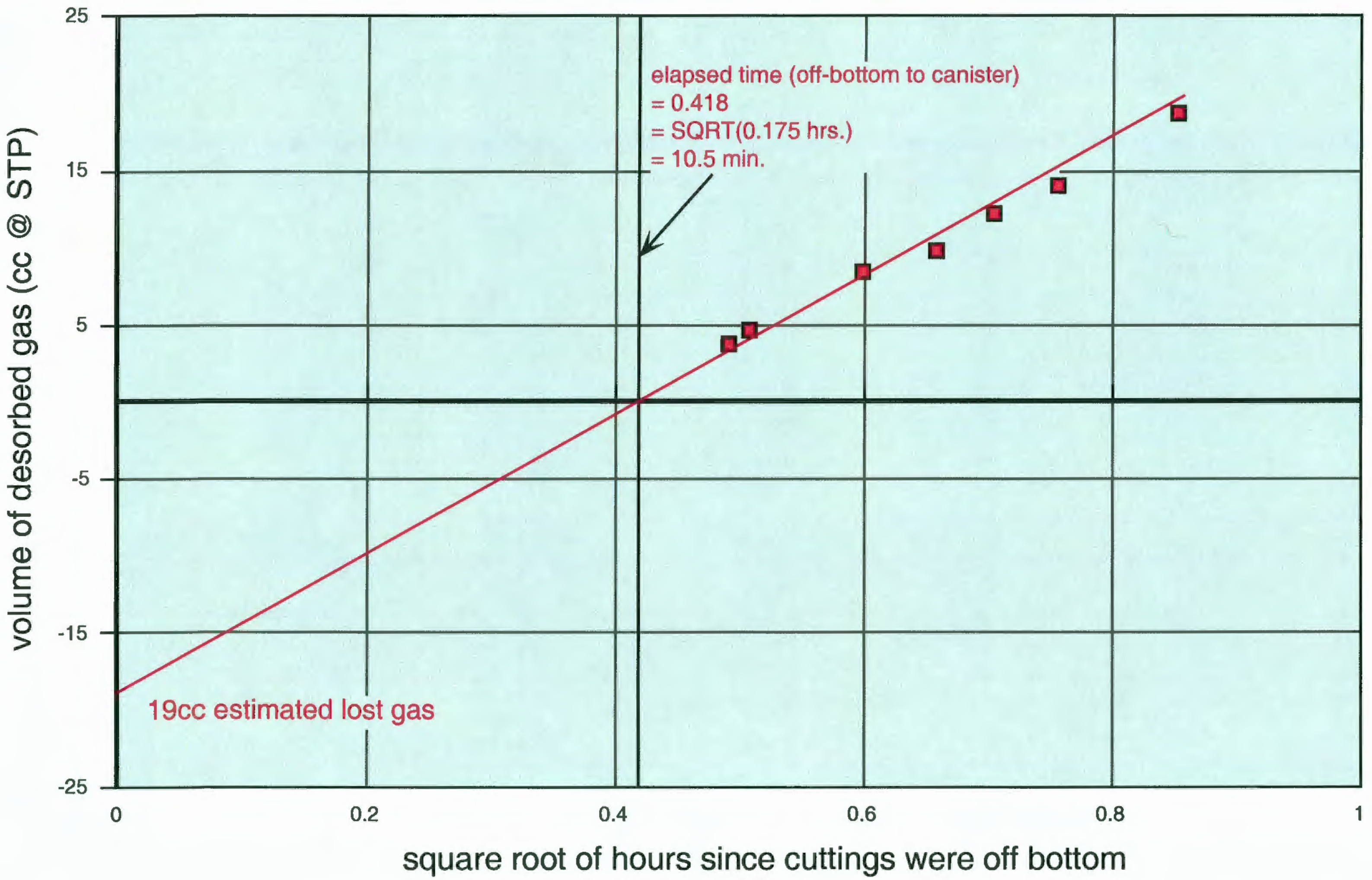
RIG MEASUREMENTS — CONVERSION OF RIG MEASUREMENTS TO STP (cubic ft, @60 degrees; @14.7 psi) — CUMULATIVE VOLUMES

measured cc	measured T (F)	measured P	cubic ft (@rig)	ABSOLUTE T (F) (@rig)	psia (@rig)	cubic ft (@STP)	cc (@STP)	air-space adjusted vol. (cc)	air-space adjusted vol. (cubic ft@STP)	air-space adjusted vol. (cc @STP)	air-space-adjusted cum. vol. (cubic ft@STP)	air-space-adjusted cum. vol. (cc@STP)	SCF/TON with lost gas	TIME OF MEASURE		TIME SINCE off bottom	in canister	SQRT hrs. (since off bottom)
	75	1075	0	535	13.953	0	0.00											
1	75	1075	3.5E-05	535	13.953	3.26E-05	0.92	1.00	3.3E-05	0.92	3.28E-05	0.92	**11.51**	2/14/03	1:29	0:22:45	0:01:45	0.8157651
4	75	1075	0.00014	535	13.953	0.00013	3.69	4.00	0.00013	3.69	0.000163	4.61	**12.55**	2/14/03	1:36	0:29:30	0:08:30	0.7011895
5	75	1075	0.00018	535	13.953	0.000163	4.61	5.00	0.00016	4.61	0.000326	9.23	**13.64**	2/14/03	1:40	0:33:30	0:12:30	0.7472171
2.5	75	1074	8.8E-05	535	13.940	8.14E-05	2.30	1.45	4.7E-05	1.34	0.000373	10.57	**14.22**	2/14/03	1:44	0:37:30	0:16:30	0.7905694
2.5	75	1074	8.8E-05	535	13.940	8.14E-05	2.30	2.50	8.1E-05	2.30	0.000454	12.87	**14.87**	2/14/03	1:48	0:39:45	0:18:45	0.813941
5	75	1074	0.00018	535	13.940	0.000163	4.61	5.00	0.00016	4.61	0.000617	17.48	**16.17**	2/14/03	1:52	0:45:45	0:24:45	0.8732125
7	75	1073	0.00025	535	13.927	0.000228	6.45	5.95	0.00019	5.48	0.000811	22.96	**17.71**	2/14/03	2:03	0:56:30	0:35:30	0.9703951
6	75	1073	0.00021	535	13.927	0.000195	5.53	6.00	0.0002	5.53	0.001006	26.48	**19.26**	2/14/03	2:11	1:05:00	0:44:00	1.040833
5	75	1073	0.00018	535	13.927	0.000163	4.60	5.00	0.00016	4.60	0.001169	33.09	**20.56**	2/14/03	2:19	1:12:30	0:51:30	1.0992422
4	75	1073	0.00014	535	13.927	0.00013	3.68	4.00	0.00013	3.68	0.001299	36.77	**21.59**	2/14/03	2:25	1:18:45	0:57:45	1.1456439
3	75	1074	0.00011	535	13.940	9.77E-05	2.77	4.05	0.00013	3.73	0.00143	40.50	**22.84**	2/14/03	2:32	1:25:30	1:04:30	1.1937336
125	80	1068	0.00441	540	13.862	0.004009	113.51	106.12	0.00347	98.16	0.004896	138.66	**50.25**	2/14/03	16:23	17:16:30	16:55:30	4.1563205
-2	80	1083	-7.1E-05	540	14.057	-6.5E-05	-1.84	13.57	0.00044	12.50	0.005339	151.16	**53.77**	2/17/03	14:31	85:24:30	85:03:30	9.2416629
0	80	1084	0	540	14.070	0	0.00	1.04	3.4E-05	0.96	0.005373	152.13	**54.04**	2/18/03	16:42	113:35:30	113:14:30	10.657939
-9	80	1090	-0.00032	540	14.148	-0.000295	-8.34	-2.81	-9.2E-05	-2.61	0.005281	149.53	**53.30**	2/19/03	13:38	132:31:30	132:10:30	11.51195
0	80	1084	0	540	14.070	0	0.00	-6.22	-0.0002	-5.74	0.005078	143.79	**51.69**	2/20/03	16:31	159:24:30	159:03:30	12.625701
-21	80	1090	-0.00074	540	14.148	-0.000687	-19.46	-14.81	-0.00048	-13.73	0.004593	130.07	**47.83**	2/23/03	22:26	237:19:30	236:58:30	15.405356
-13	80	1100	-0.00046	540	14.276	-0.000429	-12.16	-2.78	-9.2E-05	-2.60	0.004501	127.47	**47.10**	2/24/03	14:12	253:05:30	252:44:30	15.908855
10	80	1084	0.00035	540	14.070	0.000325	9.22	-6.59	-0.00021	-6.08	0.004287	121.39	**45.39**	2/26/03	15:43	302:36:30	302:15:30	17.395841
3	80	1083	0.00011	540	14.057	9.76E-05	2.76	1.96	6.4E-05	1.81	0.004351	123.20	**45.90**	2/27/03	18:48	329:41:30	329:20:30	18.157414

DECANISTERED 2/28/03

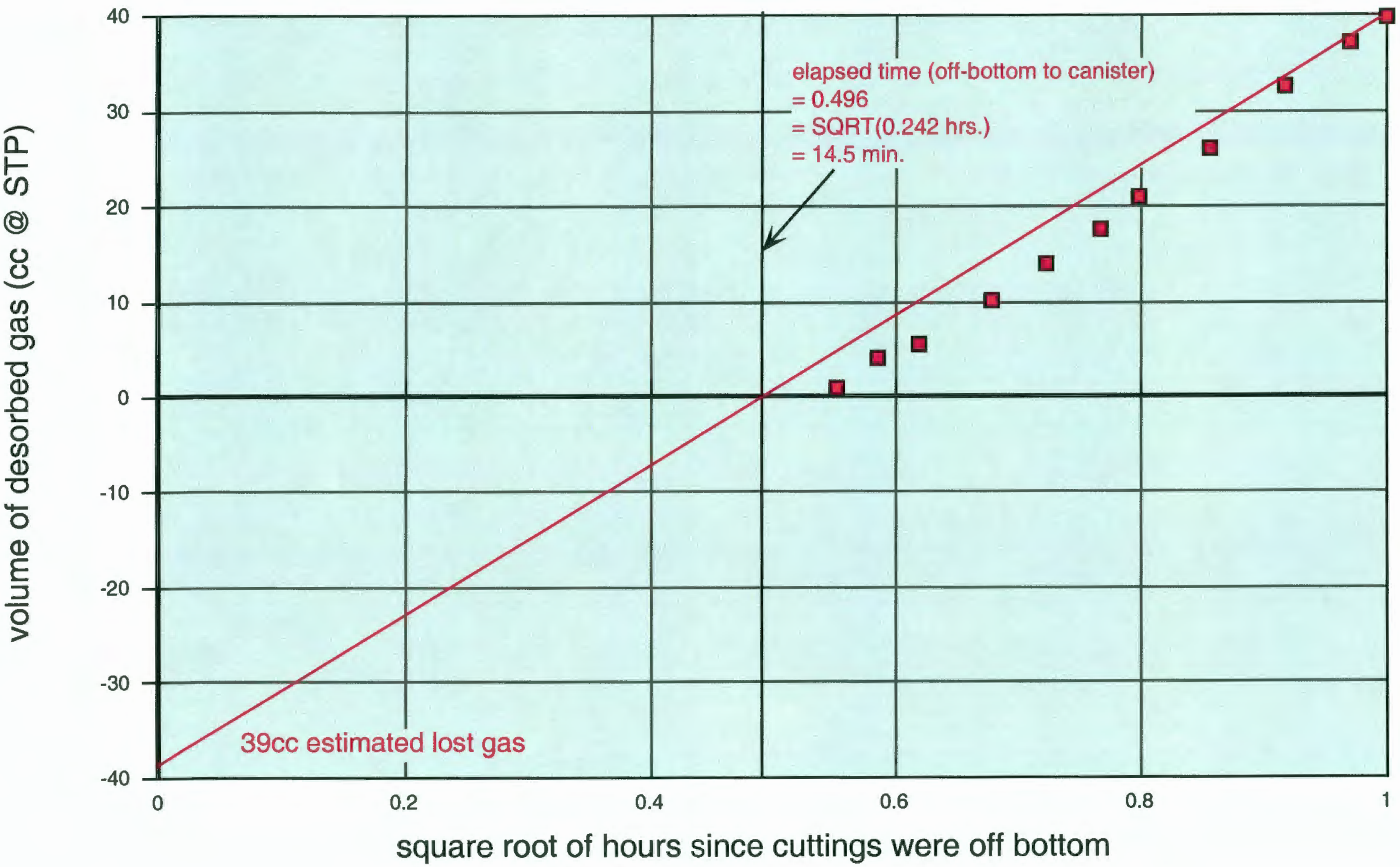
1039' to 1041' (Mineral coal) in canister 9

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E., Atchison County, KS



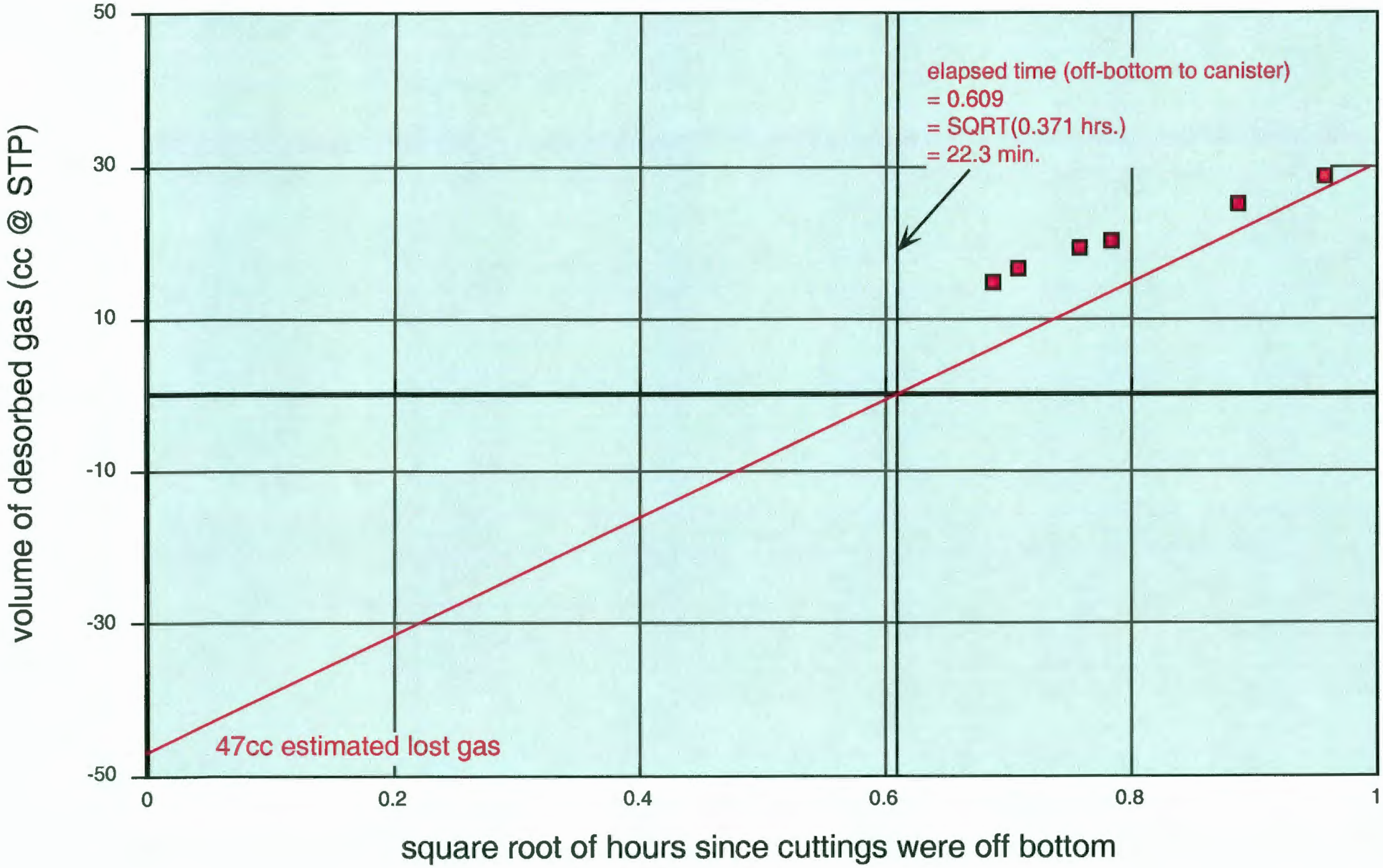
1260' to 1262' (Krebs coal) in canister Mer B

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E., Atchison County, KS



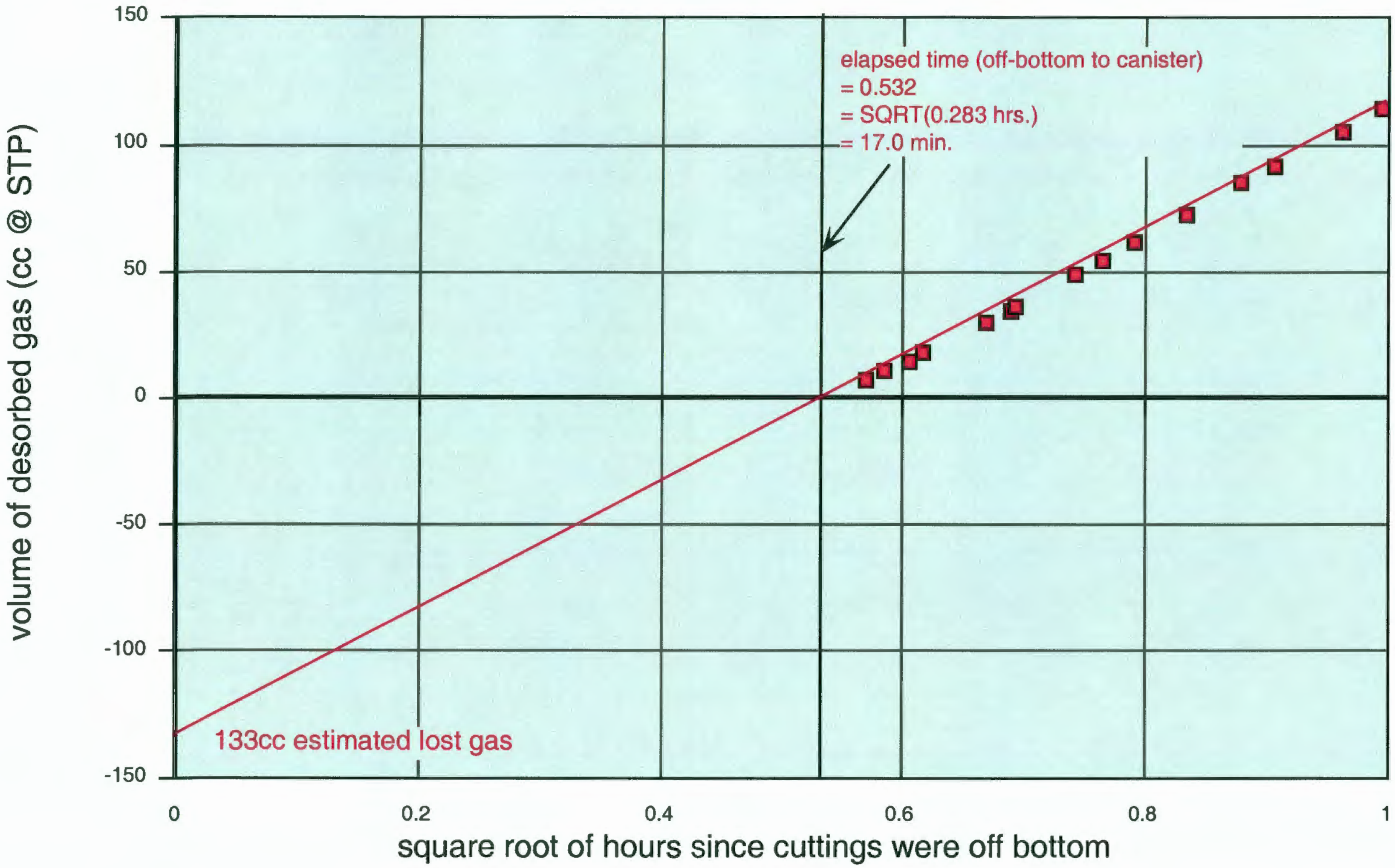
1340' to 1342' (Rowe Coal) in canister 11

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E., Atchison County, KS



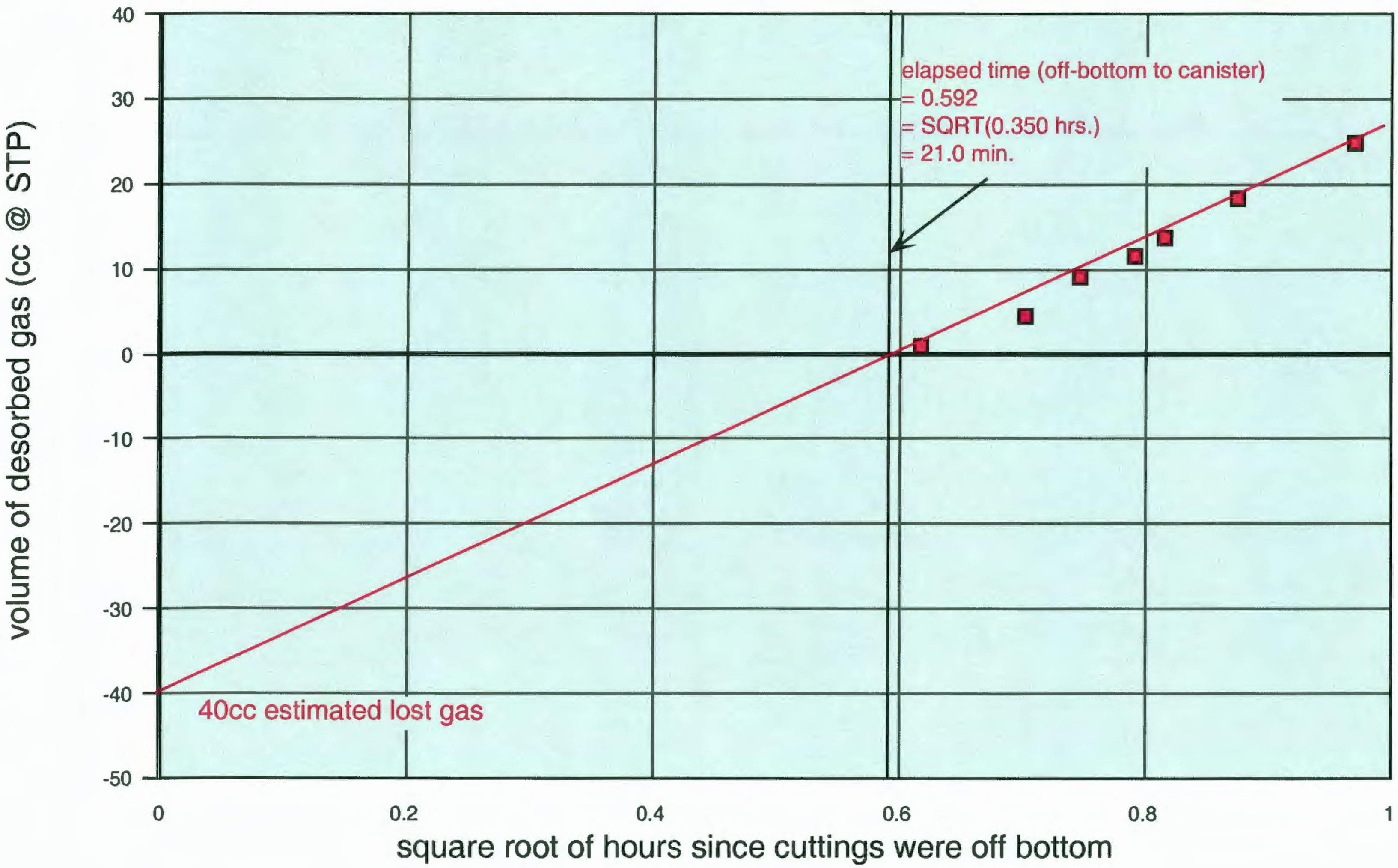
1342' to 1345' (Rowe coal) in canister B

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E., Atchison County, KS



1406' to 1409' (Riverton coal) in canister 10

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E., Atchison County, KS



Desorption Characteristics of Cuttings Samples

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E.; Atchison Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Mineral coal from 1039-1041'

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

total gas desorbed = 80 ccs

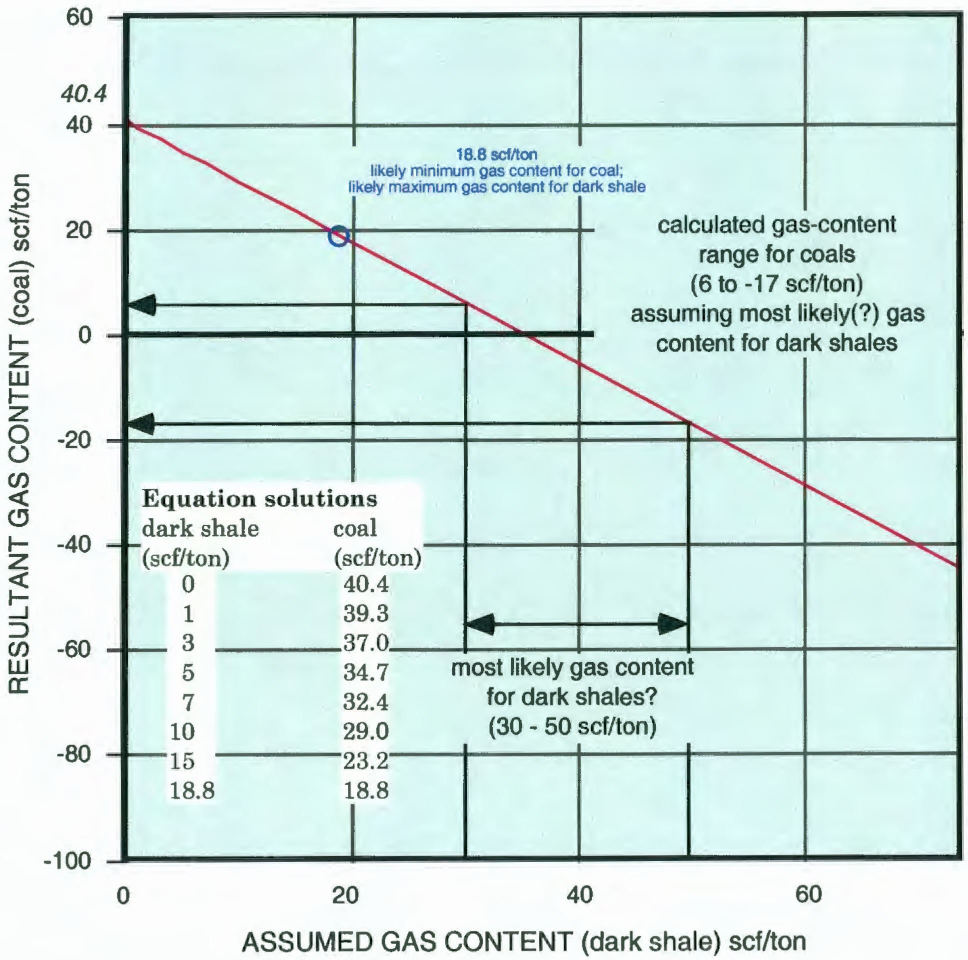
TOTAL DRY WEIGHT OF SAMPLE = 228.45 grams

$\text{weight}_{\text{light-colored lithologies}}$ = 92.08 grams (40.3%)

$\text{weight}_{\text{dark shale}}$ = 72.89 grams (31.9%)

$\text{weight}_{\text{coal}}$ = 63.49 grams (27.8%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	87.52	18.56% / 31.74% / 49.70%
>0.0661"	46.50	32.60% / 35.78% / 31.62%
>0.0460"	53.09	38.21% / 27.69% / 34.10%
>0.0331"	21.42	27.85% / 34.18% / 37.97%
<0.0331"	19.93	29.30% / 32.35% / 38.35%
	228.45 TOTAL	



Desorption Characteristics of Cuttings Samples

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E.; Atchison Co., KS

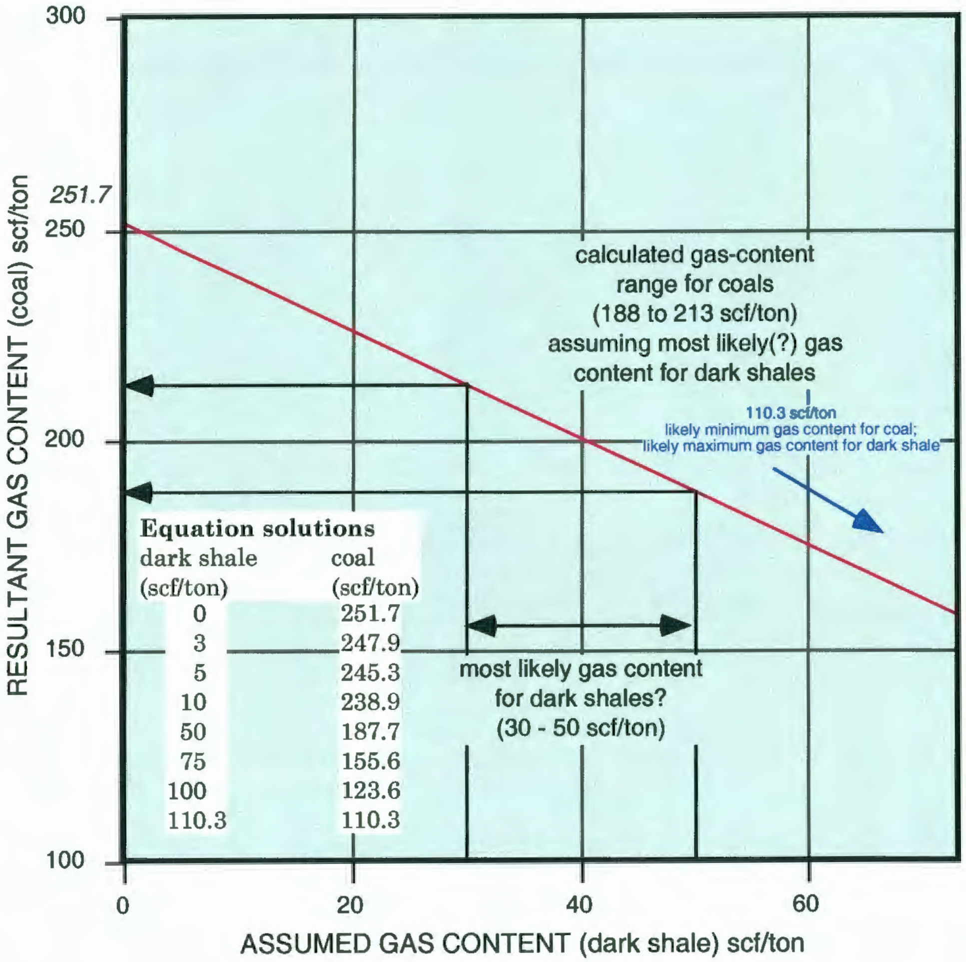
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Krebs coal from 1260-1262'

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

total gas desorbed = 212 ccs

TOTAL DRY WEIGHT OF SAMPLE = 237.76 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 176.29 grams (74.2%)
$\text{weight}_{dark\ shale}$ = 34.53 grams (14.5%)
weight_{coal} = 26.94 grams (11.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	54.66	8.13% / 14.46% / 77.40%
>0.0661"	65.83	9.88% / 12.59% / 77.53%
>0.0460"	75.09	14.29% / 15.31% / 70.41%
>0.0331"	24.87	13.24% / 17.16% / 69.61%
<0.0331"	17.32	11.38% / 14.88% / 73.74%
	237.76 TOTAL	



Desorption Characteristics of Cuttings Samples

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E.; Atchison Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Rowe coal from 1340-1342'

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

total gas desorbed = 101 ccs

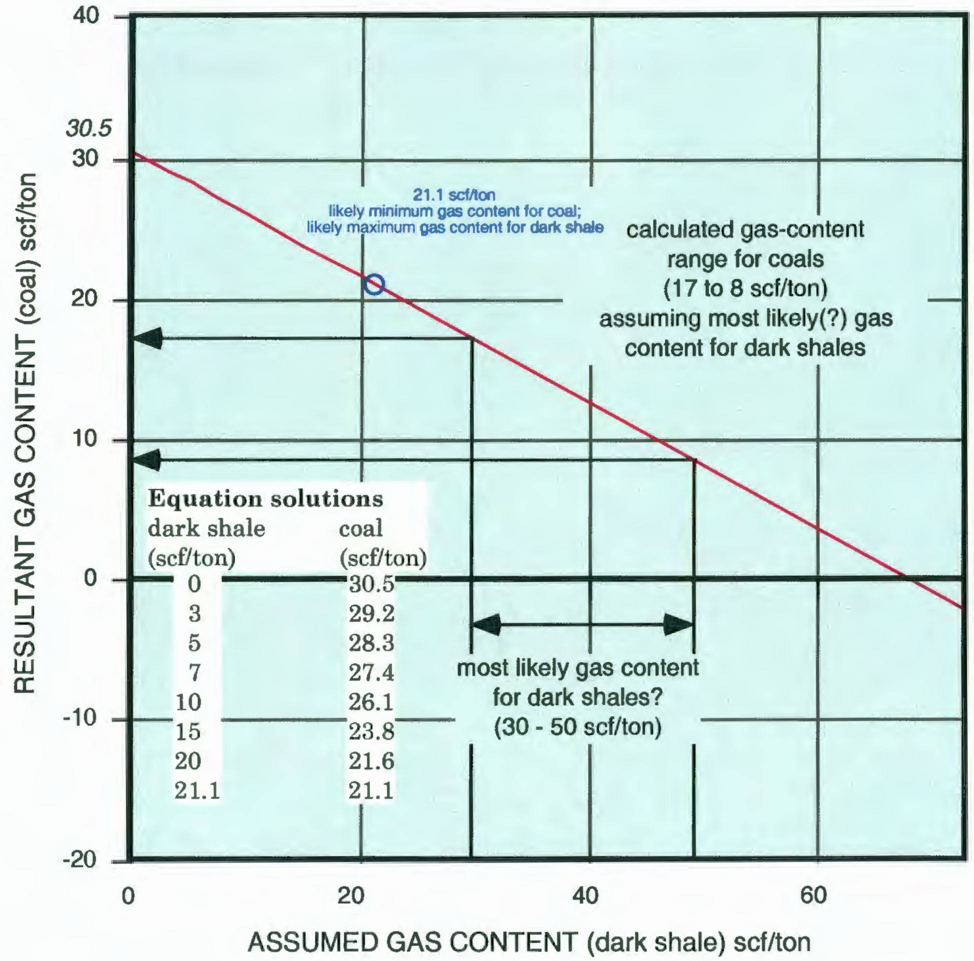
TOTAL DRY WEIGHT OF SAMPLE = 292.42 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 138.87 grams (47.5%)

$\text{weight}_{dark\ shale}$ = 47.41 grams (16.2%)

weight_{coal} = 106.14 grams (36.3%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	96.37	34.40% / 13.01% / 52.59%
>0.0661"	64.91	34.04% / 19.29% / 46.68%
>0.0460"	77.05	38.65% / 16.87% / 44.48%
>0.0331"	31.45	40.57% / 17.71% / 41.71%
<0.0331"	22.64	36.91% / 16.72% / 46.37%
	292.42 TOTAL	



Desorption Characteristics of Cuttings Samples

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E.; Atchison Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Rowe coal from 1342-1345'

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

total gas desorbed = 678 ccs

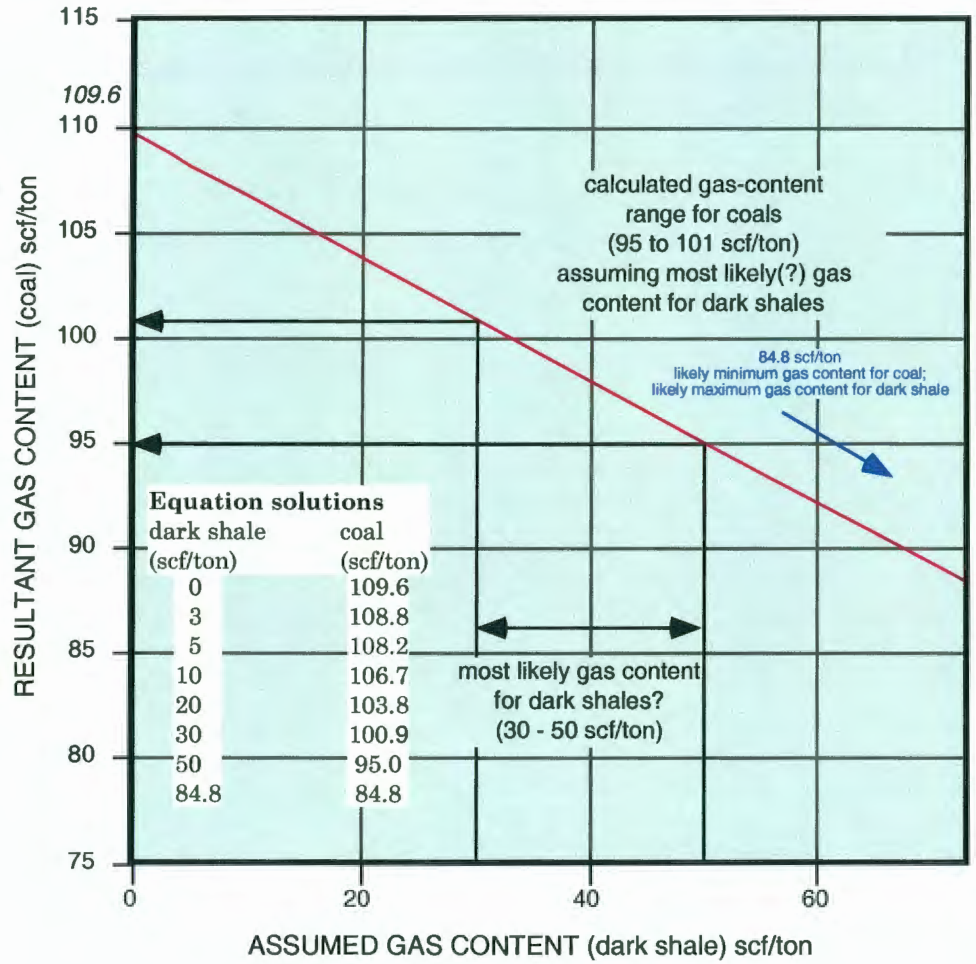
TOTAL DRY WEIGHT OF SAMPLE = 341.44 grams

$\text{weight}_{light\text{-}colored\ lithologies}$ = 85.33 grams (25.0%)

$\text{weight}_{dark\ shale}$ = 58.00 grams (17.0%)

weight_{coal} = 198.11 grams (58.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	68.11	57.96% / 15.67% / 26.37%
>0.0661"	90.78	54.14% / 16.77% / 29.09%
>0.0460"	116.49	63.68% / 14.80% / 21.52%
>0.0331"	44.45	51.76% / 24.71% / 23.53%
<0.0331"	21.61	56.89% / 17.98% / 25.13%
	341.44 TOTAL	



Desorption Characteristics of Cuttings Samples

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E.; Atchison Co., KS

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton coal from 1406-1409'

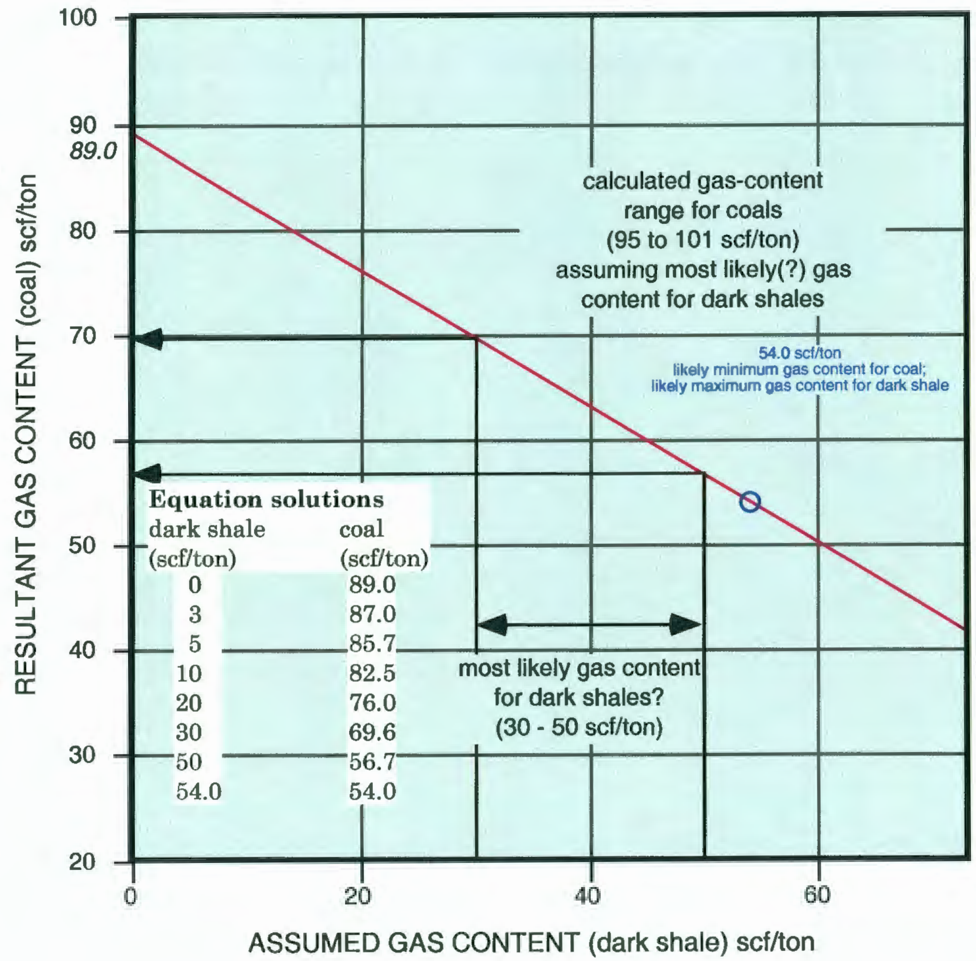
$$\text{GAS CONTENT}_{\text{coal}} = \frac{\text{total gas desorbed} - ((\text{gas content}_{\text{dark shale}}) * (\text{weight}_{\text{dark shale}}))}{\text{weight}_{\text{coal}}}$$

total gas desorbed = 192 ccs

TOTAL DRY WEIGHT OF SAMPLE = 268.02 grams

$\text{weight}_{\text{light-colored lithologies}}$ =	154.11 grams (57.5%)
$\text{weight}_{\text{dark shale}}$ =	44.73 grams (16.7%)
$\text{weight}_{\text{coal}}$ =	69.19 grams (25.8%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	53.25	17.56% / 11.36% / 71.08%
>0.0661"	71.17	20.05% / 14.81% / 65.14%
>0.0460"	91.41	31.95% / 19.85% / 48.20%
>0.0331"	32.82	34.67% / 20.67% / 44.67%
<0.0331"	18.37	26.06% / 16.67% / 57.27%
	268.02 TOTAL	



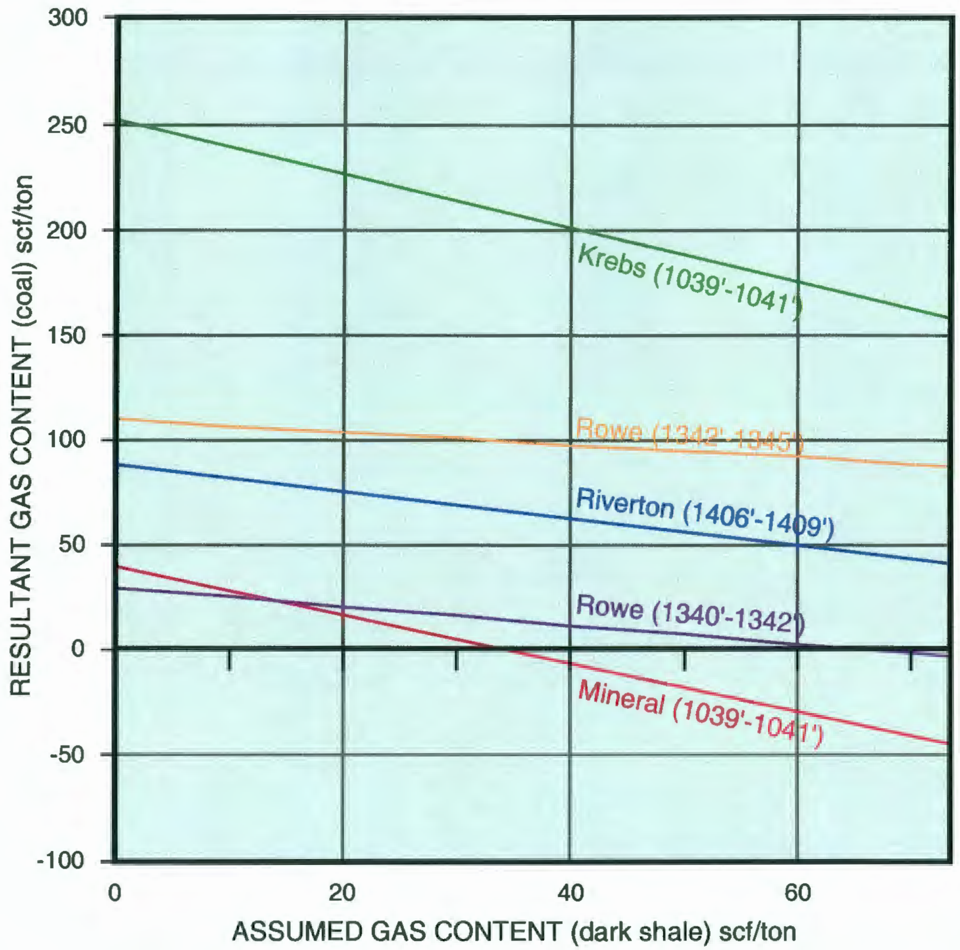
Desorption Characteristics of Cuttings Samples

BTA Oil Producers 20104 JV-P Walnut #5 SWD; sec. 5-T.7S.-R.21E.; Atchison Co., KS

surface
100'
200'
300'
400'
500'
600'
700'
800'
900'
1000'
1039' to 1041' Mineral
1100'
1200'
1260'-1262' Krebs
1300'
1340'-1342' Rowe
1342'-1345' Rowe
1400'
1406'-1409' Riverton
1500'

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for all samples

UNIT	coal in sample	scf/ton w/ shale @ 3 scf/ton	maximum scf/ton	minimum scf/ton
Mineral	28%	37.0	40.4	18.8
Krebs	11%	247.7	251.7	110.3
Rowe (1340')	36%	29.2	30.5	21.1
Rowe (1342')	58%	108.8	109.6	84.8
Riverton	26%	87.0	89.0	54.0



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

BTA Oil Producers 20104 JV-P Walnut #5 SWD

622' FSL, 2154' FEL, 5-T.7S.-R.21E.; Atchison County, KS