ANALYSIS OF CHEROKEE GROUP CUTTINGS SAMPLES FOR GAS CONTENT -- DART CHEROKEE BASIN OPERATING COMPANY #B4-23 S.F. HUSER, W2 SE SE NE 23-T.30S.-R.13E., WILSON COUNTY, KANSAS

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SUMMARY

Cuttings samples from the Pennsylvanian Cherokee Group were collected from the Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS. The samples calculate as having the following gas contents:

- Dawson(?) coal at 880' depth[1, 2] (--- scf/ton)
- unidentified coal at 1087' depth[3] (93 scf/ton)
- unidentified black shale at 1114' depth[2] (25 scf/ton)
- unidentified shale at 1171' depth, with Bevier coal[2] (19 scf/ton)
- Croweburg coal at 1185' depth[4, 5] (841 scf/ton)
- Tebo coal at 1255' depth[4] (166 scf/ton)
- shale at 1285' depth, with Weir-Pittsburg coal[2] (4 scf/ton)
- unidentified shale at 1430' depth[6] (--- scf/ton)
- Riverton coal at 1466' depth[3] (149 scf/ton)
- "top of Mississippian" at 1560' depth[7] (--- scf/ton)

[1]no significant gas desorbed
[2]no significant coal in sample
[3]assuming accompanying dark shales in sample desorb 3 scf/ton
[4]assuming accompanying dark shales in sample desorb 20 scf/ton
[5]shales likely desorb more than 20 scf/ton, coals concomitantly less
[6]surface time, canistering time not noted
[7]defective canister

BACKGROUND

The Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson 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 April 7 and 8, 2005 by personnel from Dart Cherokee Basin L.L.C., and soon turned over to LeaAnn Davidson of the Kansas Geological Survey. Samples were obtained during normal drilling of the well, with no cessation of drilling before zones of interest (i.e., coals and dark shales in the Cherokee Group) were penetrated.

The samples were canistered, with surface time and canistering times noted. These samples were collected in canisters that were supplied by Dart Cherokee Basin L.L.C. and the Kansas Geological Survey. Lag times for samples to reach the surface (important were determined by the wellsite geologist and driller.

The cuttings samples from the Pennsylvanian Cherokee Group were:

- Dawson(?) coal at 880' depth[1] (---- grams)
- unidentified coal at 1087' depth (228 grams)
- unidentified black shale at 1114' depth (221 grams)
- unidentified shale at 1171' depth, with Bevier coal (317 grams)
- Croweburg coal at 1185' depth (670 grams)

- Tebo coal at 1255' depth (96 grams)
- shale at 1285' depth, with Weir-Pittsburg coal (508 grams)
- unidentified shale at 1430' depth (647 grams)
- Riverton coal at 1466' depth (614 grams)
- "top of Mississippian" at 1560' depth[1] (---- grams)

[1]sample not weighed due to unsuccessful desorption

If correct wellsite procedures were followed, the cuttings were caught in kitchen strainers as they exited the air-stream pipe emptying to the mud pit. The samples were then washed in water while in the kitchen strainers to rid them of as much drilling mud as possible before the cuttings were placed in desorption canisters. Water with zephyrn chloride biocide was then added to the canisters, with a headspace of 1 to 2 inches being preserved at the top of the canister.

Desorption measurements at the Kansas Geological Survey in Lawrence, KS were continued at approximately 70 °F. Desorption measurements were periodically made until the canisters produced negligible gas with daily 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 reading the difference in water level using the volumetric scale on the side of the burette.

The desorption canisters were obtained from SSD, Inc. in Grand Junction, CO. These canisters are 12.5 inches high (32 cm), 3 1/2 inches (9 cm) in diameter, and enclose 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 pounds per square inch (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 Vstp 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.

Lost gas for samples (i.e., the gas lost from the sample from the time it was drilled, brought to the surface, to the time it was canistered) are normally 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 the moment that the rock is cut and its cuttings circulated off bottom. Lost gas, however, had to be inferred for the samples collected from this well because no desorption apparatus was on site when those samples were collected. The

procedure used to infer lost gas for these samples is outlined in the section below on Lost Gas.

LITHOLOGIC ANALYSIS

Upon removal from the canisters, the cuttings were washed of drilling mud, and dried in air for at least a week. 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. The lighter-colored lithologies are considered to be incapable of generating significant amounts of gas. 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) data tables for the desorption analyses, 2) lost-gas graphs, 3) "lithologic component sensitivity analyses" showing the interdependence of gas evolved from dark shale versus coal in each sample, 4) a summary component analysis for all samples showing relative reliability of the data from all the samples.

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 (Figure 2, 3)
Surface and canistering times for each sample were noted by the wellsite geologist. Bottom hole time was inferred by subtracting lag time from surface time, with lag time determined from a depth-lag-time plot for a nearby well (Figure 2). To infer an approximate lost-gas value for each sample, a correlation of the total gas desorbed from a sample after it had been canistered to its rate of lost gas was developed using desorption

data accumulated for 42 cuttings samples obtained from air-drilled wells in the Cherokee basin in southeastern Kansas (Figure 3). The rate of lost gas used in this correlation was that amount of gas lost by the square root of 0.6 hours (the square root of 0.36 hours). By knowing the total gas given up by the sample after canistering (i.e., the total gas desorbed) a hypothetical rate of lost-gas could be calculated using the a regression line:

lost gas rate per square root of 0.36 hours = 0.1241 X (total gas desorbed in ccs) + 48.14

Once the hypothetical lost-gas rate was calculated, the lost gas could be calculated by taking the square root of the bottom-hole to canister time (derived from subtracting the lag time from the surface time), and multiplying it times the hypothetical lost-gas rate. Analysis of the lithology of the cuttings used in this correlation revealed no consistent relationship (see Figure 2), therefore further refinement of the relationship of the rate of lost gas to the total gas desorbed after canistering is not possible at this point in time.

"Lithologic Component Sensitivity Analyses" (Figures 4-10)
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 lighter-colored lithologies are considered to be incapable of generating significant amounts of gas.

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 $\text{content}_{\text{dark shale}}$ 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.

A value of 3 scf/ton for average dark shale is based on the assay of the gas content of cores of dark shales in nearby wells. However, high-gamma-ray shales (such as the Excello Shale), also colloquially known as "hot shales", typically have more organic matter and associated gas content than dark shales with no excessive gamma-ray level. Determination of gas content for a coal associated with a "hot" shale therefore carries more uncertainty than if the coal were associated with a shale without a high gamma-ray value.

In general, shale gas content does not have to be very much greater that 10 scf/ton before the associated coal starts to have a gas content less than that of the dark shale. In all the lithologic-component-sensitivity-analysis diagrams, a "break-even" point is therefore 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. 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.

Summary Component Analysis for all Samples (Figure 11)
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*$_{dark\ shale}$.

RESULTS and DISCUSSION

The unidentified coal at 1087 has the best constrained data. The Croweburg coal at 1185', the Tebo coal at 1255', and the Riverton coal at 1466' all have nearly identical slopes on the coal-gas--shale-gas crossplot (see Figure 11), which indicates nearly identical (and large) uncertainties in assigning a gas-content value to the coal. Shale associated it the Riverton coal usually have low gas content, so the assumption that shale associated with the Riverton scf/ton has 3 scf/ton is likely reasonable. Shales associated with the Tebo and Croweburg coals are commonly gassy, hence these two coals have unclear gas contents. The shale associated with the Croweburg coal, however, probably has to have gas content of at least 40 scf/ton, if the coal is to have a geologically reasonable gas content of less than approximately 500 scf/ton.

REFERENCES

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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

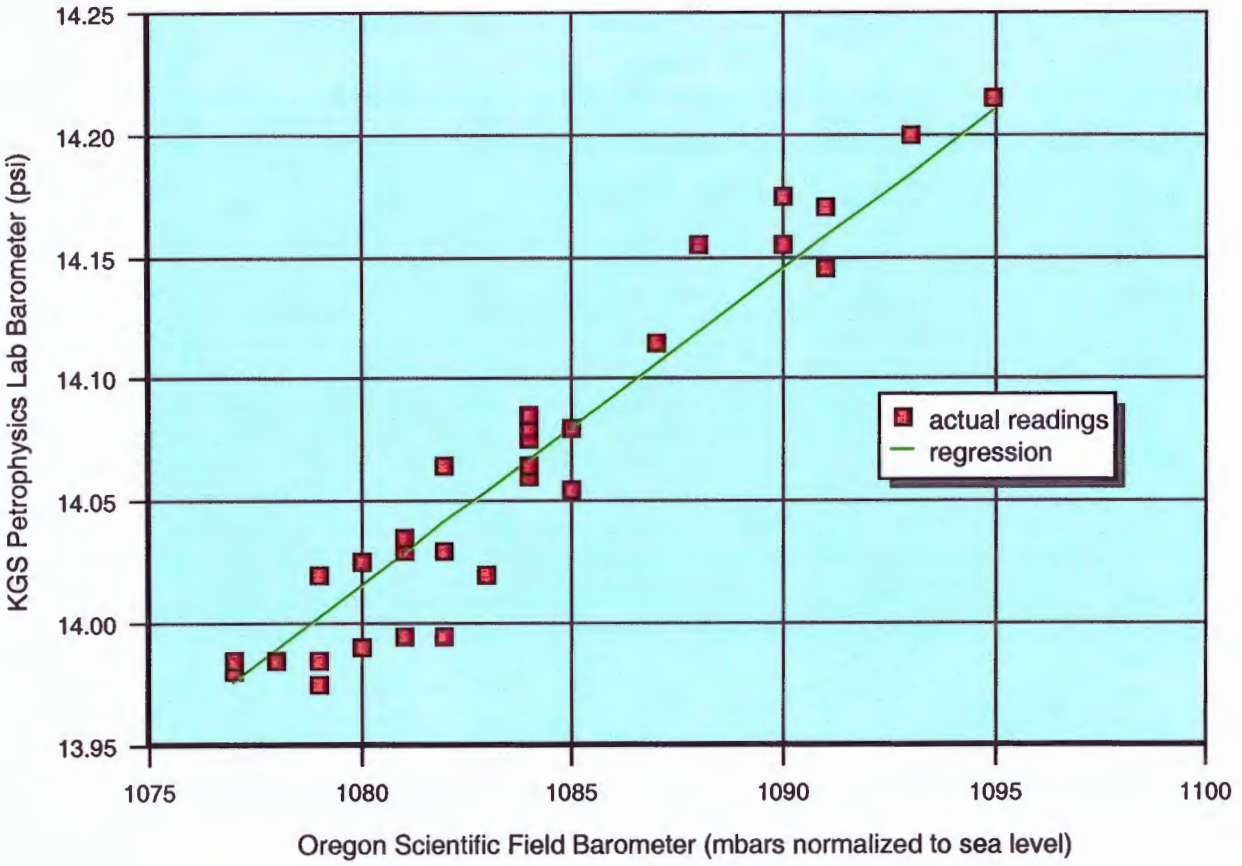


FIGURE 1.

TABLE 1 -- Desorption data for DART CHEROKEE BASIN S.F. HUSER #B4-23; W2 SE SE NE 23-T.30S.-R.13E.

SAMPLE: 880' to 882' (Dawson coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.6582	298.57

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME OF:						elapsed time (off bottom to canistering)
0	off bottom		at surface		in canister		4.3 minutes
	4/7/05	13:33	4/7/05	13:34	4/7/05	13:37	0.072 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE			0.268224616 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
9	69	1073	0.0003	529	13.927	0.000295999	8.38	0.000295999	8.38	0.90	0.90	4/9/05 13:22	47:48:44	47:44:25	6.914638257
-0.5	70	1074	-2E-05	530	13.940	-1.64286E-05	-0.47	0.00027957	7.92	0.85	0.85	4/10/05 10:23	68:49:44	68:45:25	8.296317791
2	71	1066	7E-05	531	13.836	6.51022E-05	1.84	0.000344672	9.76	1.05	1.05	4/11/05 17:05	99:31:44	99:27:25	9.976416636
-3	73	1075	-0.0001	533	13.953	-9.81083E-05	-2.78	0.000246564	6.98	0.75	0.75	4/12/05 14:14	120:40:44	120:36:25	10.98539434
-10	69	1091	-0.0004	529	14.161	-0.000334405	-9.47	-8.78407E-05	-2.49	-0.27	-0.27	4/15/05 11:01	189:27:44	189:23:25	13.76452768

DESORPTION TERMINATED 4/15/2005 DUE TO NO GAS BEING EVOLVED; no coal in sample

SAMPLE: 1087' to 1090' (? coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.2395	108.62

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME OF:						elapsed time (off bottom to canistering)
16	off bottom		at surface		in canister		4.6 minutes
	4/7/05	15:30	4/7/05	15:32	4/7/05	15:35	0.077 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE			0.276887462 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
61	69	1073	0.0022	529	13.927	0.002006213	56.81	0.002006213	56.81	16.76	21.47	4/9/05 13:49	46:18:25	46:13:49	6.804920605
10	70	1074	0.0004	530	13.940	0.000328573	9.30	0.002334786	66.11	19.50	24.22	4/10/05 10:23	66:52:25	66:47:49	8.177628697
12	71	1066	0.0004	531	13.836	0.000390613	11.06	0.002725399	77.17	22.76	27.48	4/11/05 17:05	97:34:25	97:29:49	9.877935569
2	73	1075	7E-05	533	13.953	6.54055E-05	1.85	0.002790805	79.03	23.31	28.03	4/12/05 14:14	118:43:25	118:38:49	10.89603649
0	69	1091	0	529	14.161	0	0.00	0.002790805	79.03	23.31	28.03	4/15/05 11:02	187:31:25	187:26:49	13.69392607
1	70	1076	4E-05	530	13.966	3.29185E-05	0.93	0.002823723	79.96	23.58	28.30	4/16/05 15:44	216:13:25	216:08:49	14.70454389
1	71	1082	4E-05	531	14.044	3.30397E-05	0.94	0.002856763	80.89	23.86	28.58	4/17/05 10:56	235:25:25	235:20:49	15.34352017
3	72	1082	0.0001	532	14.044	9.89328E-05	2.80	0.002955696	83.70	24.69	29.40	4/18/05 11:23	259:52:25	259:47:49	16.12059587
0	69	1076	0	529	13.966	0	0.00	0.002955696	83.70	24.69	29.40	4/20/05 21:07	317:36:25	317:31:49	17.82153036
1	70	1072	4E-05	530	13.914	3.27981E-05	0.93	0.002988492	84.62	24.96	29.68	4/21/05 17:09	337:38:25	337:33:49	18.37499055
-2	67	1081	-7E-05	527	14.031	-6.65194E-05	-1.88	0.002921973	82.74	24.40	29.12	4/22/05 16:05	360:34:25	360:29:49	18.98877592
-6	63	1083	-0.0002	523	14.057	-0.000201456	-5.70	0.002720516	77.04	22.72	27.44	4/24/05 13:40	406:09:25	406:04:49	20.15333581

DESORPTION TERMINATED 4/28/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 30 days

SAMPLE: 1114' to 1117' (black shale) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.4300	195.05

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME OF:						elapsed time (off bottom to canistering)
20	off bottom		at surface		in canister		5.7 minutes
	4/7/05	16:00	4/7/05	16:02	4/7/05	16:05	0.094 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE			0.307318149 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
102	69	1073	0.0036	529	13.927	0.003354652	94.99	0.003354652	94.99	15.60	18.89	4/9/05 14:06	46:05:47	46:00:07	6.789432148
15	70	1074	0.0005	530	13.940	0.000492859	13.96	0.003847511	108.95	17.89	21.18	4/10/05 10:24	66:23:47	66:18:07	8.148397934
14	71	1066	0.0005	531	13.836	0.000455716	12.90	0.004303226	121.85	20.01	23.30	4/11/05 17:06	97:05:47	97:00:07	9.853749991
3	73	1075	0.0001	533	13.953	9.81083E-05	2.78	0.004401335	124.63	20.47	23.76	4/12/05 14:15	118:14:47	118:09:07	10.87411555
1	69	1091	4E-05	529	14.161	3.34405E-05	0.95	0.004434775	125.58	20.63	23.91	4/15/05 11:02	187:01:47	186:56:07	13.67588104
2	70	1076	7E-05	530	13.966	6.58369E-05	1.86	0.004500612	127.44	20.93	24.22	4/16/05 15:43	215:42:47	215:37:07	14.68717316
0	71	1082	0	531	14.044	0	0.00	0.004500612	127.44	20.93	24.22	4/17/05 10:56	234:55:47	234:50:07	15.32741734
3	72	1082	0.0001	532	14.044	9.89328E-05	2.80	0.004599545	130.24	21.39	24.68	4/18/05 11:23	259:22:47	259:17:07	16.10527001
0	69	1076	0	529	13.966	0	0.00	0.004599545	130.24	21.39	24.68	4/20/05 21:07	317:06:47	317:01:07	17.80766845
1	70	1072	4E-05	530	13.914	3.27961E-05	0.93	0.004632341	131.17	21.55	24.83	4/21/05 17:06	337:05:47	337:00:07	18.36018488
-3	67	1081	-0.0001	527	14.031	-9.97791E-05	-2.83	0.004532562	128.35	21.08	24.37	4/22/05 16:06	360:05:47	360:00:07	18.97620586
-6	63	1083	-0.0002	523	14.057	-0.000201456	-5.70	0.004331105	122.64	20.14	23.43	4/24/05 13:41	405:40:47	405:35:07	20.14149255

DESORPTION TERMINATED 4/28/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 28 days

SAMPLE: 1171' to 1174' (shale associated with Bevier coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.6727	305.14

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME OF:						elapsed time (off bottom to canistering)
18	off bottom		at surface		in canister		4.3 minutes
	4/7/05	17:24	4/7/05	17:26	4/7/05	17:28	0.071 hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE			0.267186992 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)

135	69	1073	0.0048	529	13.927	0.00443998	125.73	0.00443998	125.73	13.20	15.09	4/9/05	13:32	44:07:46	44:03:29	6.642999657
18	70	1074	0.0006	530	13.940	0.000591431	16.75	0.005031411	142.47	14.96	16.85	4/10/05	10:26	65:01:46	64:57:29	8.064083608
14	71	1066	0.0005	531	13.836	0.000455716	12.90	0.005487127	155.38	16.31	18.20	4/11/05	17:07	95:42:46	95:38:29	9.783290744
3	73	1075	0.0001	533	13.953	9.81083E-05	2.78	0.005585235	158.16	16.60	18.49	4/12/05	14:16	116:51:46	116:47:29	10.81030887
0	69	1091	0	529	14.161	0	0.00	0.005585235	158.16	16.60	18.49	4/15/05	11:04	185:39:46	185:35:29	13.62581292
0 5	70	1076	2E-05	530	13.966	1.64592E-05	0.47	0.005601694	158.62	16.65	18.54	4/16/05	15:42	214:17:46	214:13:29	14.63885621
0	71	1082	0	531	14.044	0	0.00	0.005601694	158.62	16.65	18.54	4/17/05	10:57	233:32:46	233:28:29	15.28221552
3	72	1082	0.0001	532	14.044	9.89328E-05	2.80	0.005700627	161.42	16.95	18.84	4/18/05	11:24	257:59:46	257:55:29	16.06225735
-1	69	1076	-4E-05	529	13.966	-3.29807E-05	-0.93	0.005667646	160.49	16.85	18.74	4/20/05	21:09	315:44:46	315:40:29	17.76924622
1	70	1072	4E-05	530	13.914	3.27961E-05	0.93	0.005700442	161.42	16.95	18.84	4/21/05	17:11	335:46:46	335:42:29	18.32428565
-3	67	1081	-0.0001	527	14.031	-9.97791E-05	-2.83	0.005600663	158.59	16.65	18.54	4/22/05	16:07	358:42:46	358:38:29	18.9397143
-6	63	1083	-0.0002	523	14.057	-0.000201456	-5.70	0.005399207	152.89	16.05	17.94	4/24/05	13:44	404:19:46	404:15:29	20.10794481

DESORPTION TERMINATED 4/28/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 28 days

SAMPLE: 1185' to 1118' (Croweburg coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	1.2636	573.18

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = 50

TIME 0F:						elapsed time (off bottom to canistering)
off bottom		at surface		in canister		4.4 minutes
4/7/05	17:45	4/7/05	17:48	4/7/05	17:50	0.073 hours
						0.269258240 SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE				
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
631	69	1073	0.0223	529	13.927	0.020752796	587.65	0.020752796	587.65	32.85	35.64	4/9/05	13:32	43:46:09	43:41:48	6.615826983
175	70	1074	0.0062	530	13.940	0.005750024	162.82	0.02650282	750.47	41.95	44.74	4/10/05	10:26	64:40:09	64:35:48	8.041714162
115	71	1066	0.0041	531	13.836	0.003743378	106.00	0.030246198	856.47	47.87	50.67	4/11/05	17:07	95:21:09	95:16:48	9.76486047
54	73	1075	0.0019	533	13.953	0.001765949	50.01	0.032012148	906.48	50.67	53.46	4/12/05	14:16	116:30:09	116:25:48	10.79363238
65	69	1091	0.0023	529	14.161	0.00217363	61.55	0.034185778	968.03	54.11	56.90	4/15/05	11:04	185:18:09	185:13:48	13.61258609
28	70	1076	0.001	530	13.966	0.000921717	26.10	0.035107495	994.13	55.57	58.36	4/16/05	15:42	213:56:09	213:51:48	14.6265455
16	71	1082	0.0006	531	14.044	0.000528635	14.97	0.03563613	1009.10	56.40	59.20	4/17/05	10:57	233:11:09	233:06:48	15.27042348
19	72	1082	0.0007	532	14.044	0.000626574	17.74	0.036262704	1026.84	57.39	60.19	4/18/05	11:24	257:38:09	257:33:48	16.05103839
22	69	1076	0.0008	529	13.966	0.000725575	20.55	0.036988279	1047.39	58.54	61.34	4/20/05	21:09	315:23:09	315:18:48	17.75910565
10	70	1072	0.0004	530	13.914	0.000327961	9.29	0.03731624	1056.67	59.06	61.86	4/21/05	17:11	335:25:09	335:20:48	18.3144524
5	67	1081	0.0002	527	14.031	0.000166298	4.71	0.037482539	1061.38	59.32	62.12	4/22/05	16:07	358:21:09	358:16:48	18.93020074
2	63	1083	7E-05	523	14.057	6.71522E-05	1.90	0.037549691	1063.28	59.43	62.23	4/24/05	13:44	403:58:09	403:53:48	20.09898422
14	68	1071	0.0005	528	13.901	0.000460455	13.04	0.038010146	1076.32	60.16	62.95	4/25/05	19:28	433:42:09	433:37:48	20.8255252
6	66	1082	0.0002	526	14.044	0.000200123	5.67	0.038210268	1081.99	60.48	63.27	4/27/05	16:57	479:11:09	479:06:48	21.89031369
11	68	1080	0.0004	528	14.018	0.000364826	10.33	0.038575094	1092.32	61.05	63.85	4/28/05	15:08	501:22:09	501:17:48	22.39127434
11	68	1082	0.0004	528	14.044	0.000365502	10.35	0.038940596	1102.67	61.63	64.43	4/29/05	16:31	526:45:09	526:40:48	22.9510893
7	66	1086	0.0002	526	14.096	0.000234339	6.64	0.039174935	1109.31	62.00	64.80	4/30/05	18:57	553:11:09	553:06:48	23.51990292
-7	68	1089	-0.0002	528	14.135	-0.000234097	-6.63	0.038940838	1102.68	61.63	64.43	5/1/05	18:41	576:55:09	576:50:48	24.01914167
1	70	1089	4E-05	530	14.135	3.33162E-05	0.94	0.038974154	1103.62	61.69	64.48	5/2/05	20:29	602:43:09	602:38:48	24.55033944
0.5	66	1093	2E-05	526	14.187	1.68464E-05	0.48	0.038991001	1104.10	81.71	64.51	5/5/05	6:46	661:00:09	660:55:48	25.70996888
-1	71	1075	-4E-05	531	13.953	-3.28259E-05	-0.93	0.038958175	1103.17	61.66	64.45	5/6/05	18:37	696:51:09	696:46:48	26.39796394
-1	71	1081	-4E-05	531	14.031	-3.30092E-05	-0.93	0.038925166	1102.23	61.61	64.40	5/7/05	16:46	719:00:09	718:55:48	26.81422197

DESORPTION TERMINATED 5/7/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 20 days

SAMPLE: 1255' to 1257' (Tebo coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.1943	88.12

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) = 14

TIME 0F:						elapsed time (off bottom to canistering)
off bottom		at surface		in canister		3.6 minutes
4/7/05	18:27	4/7/05	18:29	4/7/05	18:31	0.061 hours
						0.246080384 SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE				
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
60	69	1073	0.0021	529	13.927	0.001973324	55.88	0.001973324	55.88	20.32	25.41	4/9/05	14:10	43:42:32	43:38:54	6.611269839
6	70	1074	0.0002	530	13.940	0.000197144	5.58	0.002170468	61.46	22.34	27.43	4/10/05	10:26	63:58:32	63:54:54	7.998472078
7	71	1066	0.0002	531	13.836	0.000227858	6.45	0.002398326	67.91	24.69	29.78	4/11/05	17:06	94:38:32	94:34:54	9.728423419
0	73	1075	0	533	13.953	0	0.00	0.002398326	67.91	24.69	29.78	4/12/05	14:16	115:48:32	115:44:54	10.76145385
-4	69	1091	-0.0001	529	14.161	-0.000133762	-3.79	0.002264564	64.13	23.31	28.40	4/15/05	11:03	184:35:32	184:31:54	13.58647203
0.5	70	1076	2E-05	530	13.966	1.64592E-05	0.47	0.002281023	64.59	23.48	28.57	4/16/05	15:42	213:14:32	213:10:54	14.60281556
0	71	1082	0	531	14.044	0	0.00	0.002281023	64.59	23.48	28.57	4/17/05	10:57	232:29:32	232:25:54	15.24769564
3	72	1082	0.0001	532	14.044	9.89328E-05	2.80	0.002379956	67.39	24.50	29.59	4/18/05	11:24	256:56:32	256:52:54	16.0294174
1	69	1076	4E-05	529	13.966	3.29807E-05	0.93	0.002412937	68.33	24.84	29.93	4/20/05	21:09	314:41:32	314:37:54	17.73956657
2	70	1072	7E-05	530	13.914	6.55922E-05	1.86	0.002478529	70.18	25.52	30.61	4/21/05	17:10	334:42:32	334:38:54	18.29505094
-3	67	1081	-0.0001	527	14.031	-9.97791E-05	-2.83	0.00237875	67.36	24.49	29.58	4/22/05	16:07	357:39:32	357:35:54	18.91187164
-5	63	1083	-0.0002	523	14.057	-0.00016788	-4.75	0.00221087	62.60	22.76	27.85	4/24/05	13:43	403:15:32	403:11:54	20.08130695

SAMPLE DECANISTERED 4/28/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 30 days

SAMPLE: 1285' to 1287' (shale associated with Weir-Pittsburg coal) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	1.1061	501.73

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME 0F:					elapsed time (off bottom to canistering)	
14	off bottom		at surface		in canister	4.0	minutes
	4/7/05	18:51	4/7/05	18:53	4/7/05 18:55	0.067	hours
						0.258198889	SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE			
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
41	69	1073	0.0014	529	13.927	0.001348438	38.18	0.001348438	38.18	2.44	3.33	4/9/05 14:10	43:18:40	43:14:40	6.581117771
2	70	1074	7E-05	530	13.940	6.57146E-05	1.86	0.001414153	40.04	2.56	3.45	4/10/05 10:26	63:34:40	63:30:40	7.973567444
3	71	1066	0.0001	531	13.836	9.76533E-05	2.77	0.001511806	42.81	2.73	3.63	4/11/05 17:06	94:14:40	94:10:40	9.70795779
-2	73	1075	-7E-05	533	13.953	-6.54055E-05	-1.85	0.001446401	40.96	2.62	3.51	4/12/05 14:16	115:24:40	115:20:40	10.74295635
-8	69	1091	-0.0003	529	14.161	-0.000267524	-7.58	0.001178877	33.38	2.13	3.03	4/15/05 11:06	184:14:40	184:10:40	13.57366732

SAMPLE DECANISTERED 4/17/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 20 days

SAMPLE: 1430' to 1432' (Riverton(?)) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.8151	369.74

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME 0F:					elapsed time (off bottom to canistering)	
0	off bottom		at surface		in canister	#VALUE!	minutes
	?		?		?	#VALUE!	hours
						#VALUE!	SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE			
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
62	69	1073	0.0022	529	13.927	0.002039102	57.74	0.002039102	57.74	5.00	5.00	4/9/05 13:56	#VALUE!	#VALUE!	#VALUE!
6	70	1074	0.0002	530	13.940	0.000197144	5.58	0.002236246	63.32	5.49	5.49	4/10/05 10:29	#VALUE!	#VALUE!	#VALUE!
6	71	1066	0.0002	531	13.836	0.000195307	5.53	0.002431552	68.85	5.97	5.97	4/11/05 17:10	#VALUE!	#VALUE!	#VALUE!
0	73	1075	0	533	13.953	0	0.00	0.002431552	68.85	5.97	5.97	4/12/05 14:18	#VALUE!	#VALUE!	#VALUE!
-5	69	1091	-0.0002	529	14.161	-0.000167202	-4.73	0.00226435	64.12	5.56	5.56	4/15/05 11:06	#VALUE!	#VALUE!	#VALUE!
0	70	1076	0	530	13.966	0	0.00	0.00226435	64.12	5.56	5.56	4/16/04 15:39	#VALUE!	#VALUE!	#VALUE!

SAMPLE DECANISTERED 4/17/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 20 days

SAMPLE: 1466' to 1468' (Riverton(?)) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.8313	377.05

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME 0F:					elapsed time (off bottom to canistering)	
18	off bottom		at surface		in canister	4.5	minutes
	4/8/05	8:47	4/8/05	8:50	4/8/05 8:51	0.075	hours
						0.274367960	SQRT (hrs)

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)				CUMULATIVE VOLUMES		SCF/TON	SCF/TON	TIME SINCE			
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
88	69	1073	0.0031	529	13.927	0.002894209	81.95	0.002894209	81.95	6.96	8.49	4/9/05 13:28	28:40:35	28:36:04	5.355033976
16	70	1074	0.0006	530	13.940	0.000525716	14.89	0.003419926	96.84	8.23	9.76	4/10/05 10:30	49:42:35	49:38:04	7.050512196
14	71	1066	0.0005	531	13.836	0.000455716	12.90	0.003875641	109.75	9.32	10.85	4/11/05 17:10	80:22:35	80:18:04	8.965287998
3	73	1075	0.0001	533	13.953	9.81083E-05	2.78	0.00397375	112.52	9.56	11.09	4/12/05 14:18	101:30:35	101:26:04	10.07520333
0	69	1091	0	529	14.161	0	0.00	0.00397375	112.52	9.56	11.09	4/15/05 11:07	170:19:35	170:15:04	13.05091525
2	70	1076	7E-05	530	13.966	6.58369E-05	1.86	0.004039587	114.39	9.72	11.25	4/16/05 15:38	198:50:35	198:46:04	14.10117213
1	71	1082	4E-05	531	14.044	3.30397E-05	0.94	0.004072626	115.32	9.80	11.33	4/17/05 11:00	218:12:35	218:08:04	14.77192344
4	72	1082	0.0001	532	14.044	0.00013191	3.74	0.004204537	119.06	10.12	11.65	4/18/05 11:25	242:37:35	242:33:04	15.57646908
1	69	1076	4E-05	529	13.966	3.29807E-05	0.93	0.004237517	119.99	10.20	11.72	4/20/05 21:10	300:22:35	300:18:04	17.33137008
2	70	1072	7E-05	530	13.914	6.55922E-05	1.86	0.00430311	121.85	10.35	11.88	4/21/05 17:12	320:24:35	320:20:04	17.89999224
-2	67	1081	-7E-05	527	14.031	-6.65194E-05	-1.88	0.00423659	119.97	10.19	11.72	4/22/05 16:10	343:22:35	343:18:04	18.53041794
-4	63	1083	-0.0001	523	14.057	-0.000134304	-3.80	0.004102288	116.16	9.87	11.40	4/24/05 13:45	388:57:35	388:53:04	19.72206181
8	68	1071	0.0003	528	13.901	0.000263117	7.45	0.004365403	123.61	10.50	12.03	4/25/05 19:29	418:41:35	418:37:04	20.46199051
4	68	1080	0.0001	528	14.018	0.000132664	3.76	0.004498067	127.37	10.82	12.35	4/28/05 15:09	486:21:35	486:17:04	22.05356484
4	68	1082	0.0001	528	14.044	0.00013291	3.76	0.004630976	131.13	11.14	12.67	4/29/05 16:32	511:44:35	511:40:04	22.62173856
0	66	1086	0	526	14.096	0	0.00	0.004630976	131.13	11.14	12.67	4/30/05 18:58	538:10:35	538:06:04	23.19862903
-5	68	1089	-0.0002	528	14.135	-0.000167212	-4.73	0.004463764	126.40	10.74	12.27	5/1/05 18:42	561:54:35	561:50:04	23.70463504
0	70	1089	0	530	14.135	0	0.00	0.004463764	126.40	10.74	12.27	5/2/05 20:29	587:41:35	587:37:04	24.24238139
-2	66	1093	-7E-05	526	14.187	-8.73857E-05	-1.91	0.004396379	124.49	10.58	12.11	5/5/05 6:47	645:59:35	645:55:04	25.41639344

SAMPLE DECANISTERED 5/05/2005 DUE TO NO MORE GAS BEING EVOLVED; sample air dried for 16 days

SAMPLE: 1516' to 1519' ("top of Missisipplan" interval) cuttings in Dart SSD canister

	lbs.	grams
dry sample weight:	0.4306	195.33

NOTE: lost gas is estimated by time interval between at surface and canister times, and total gas evolved

est. lost gas (cc) =	TIME 0F:					elapsed time (off bottom to canistering)	
0	off bottom		at surface		in canister	7.7	minutes
	4/8/05	9:14	4/8/05	9:17	4/8/05 9:21	0.128	hours

RIG/LAB MEASUREMENTS			CONVERSION OF RIG/LAB MEASUREMENTS TO STP (@60 deg F; 14.7 psi)					CUMULATIVE VOLUMES		SCF/TON	SCF/TON		TIME SINCE		0.357071422 SQRT (hrs)
measured cc	measured T (F)	measured P	cubic ft	absolute T (R)	psia	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)
0	0	0	0	460	0.000	0	0.00	0	0.00	0.00	0.00				

SAMPLE DECANISTERED 4/12/2005 DUE TO NO GAS BEING EVOLVED (LEAKY CANISTER); sample air dried for 14 days

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

(based on lag times from Dart Cherokee Basin #CH-1 Holder; sec. 1-T.30S.-R.14E., Wilson County, KS

lag-time to surface for well cuttings

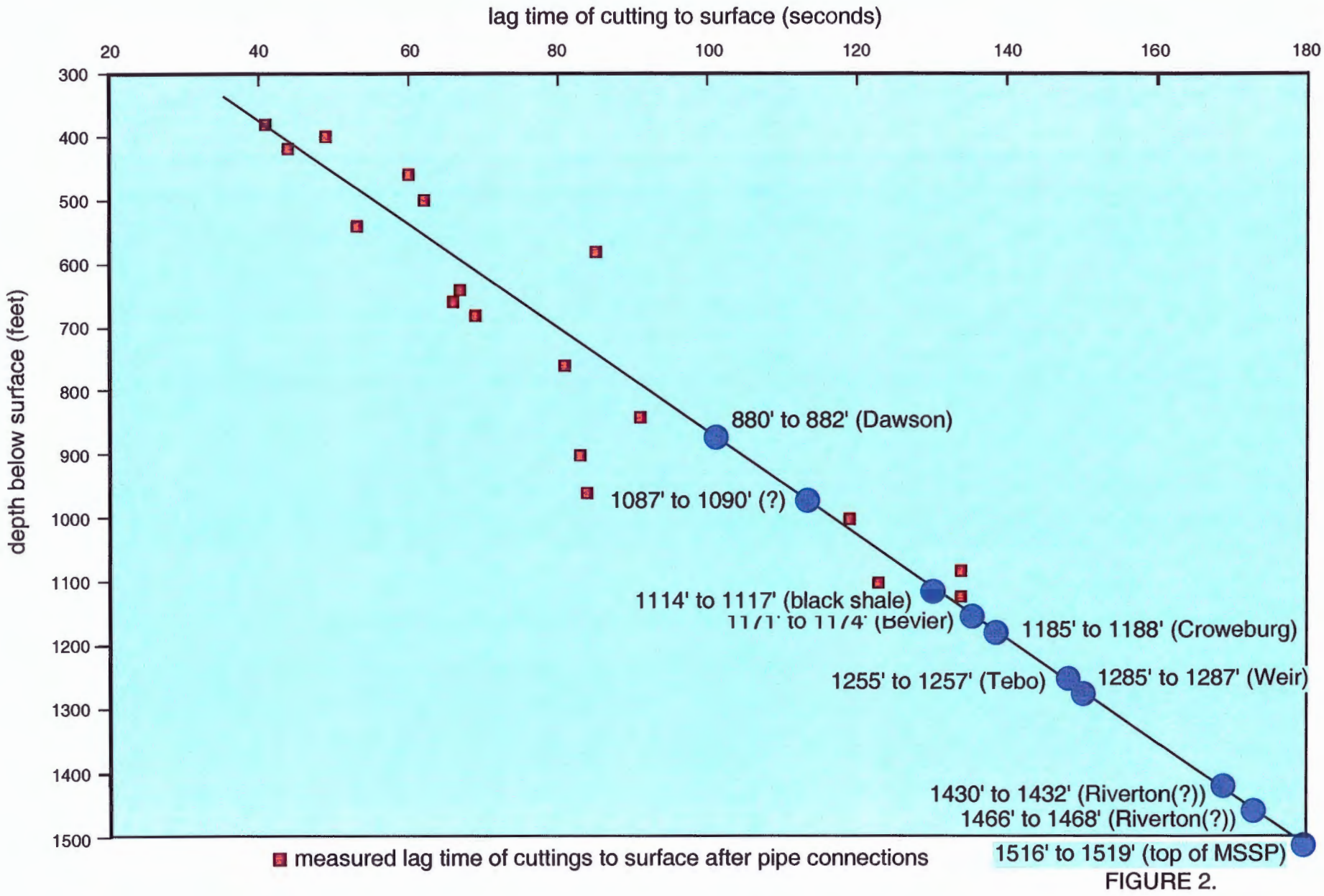
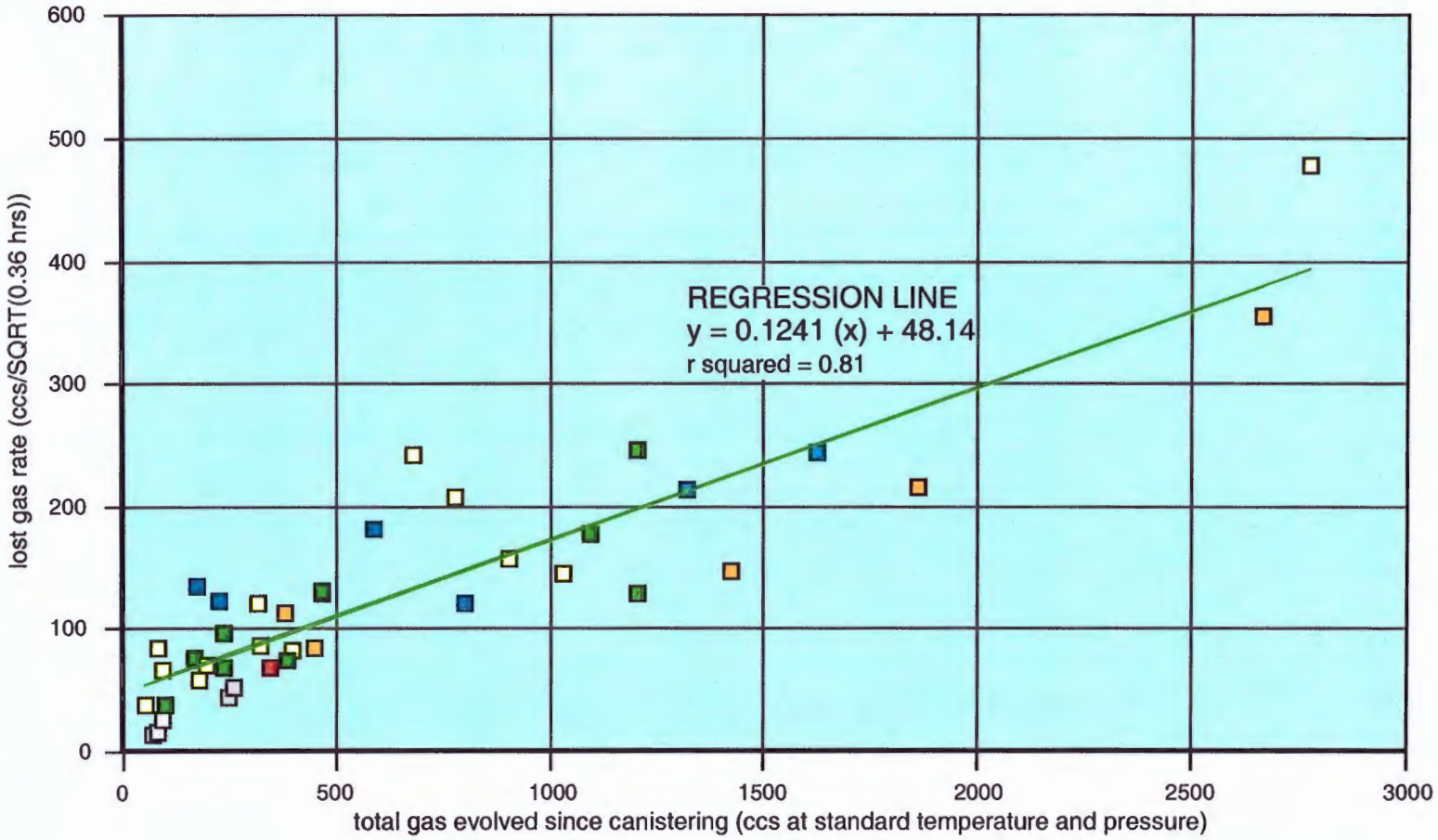
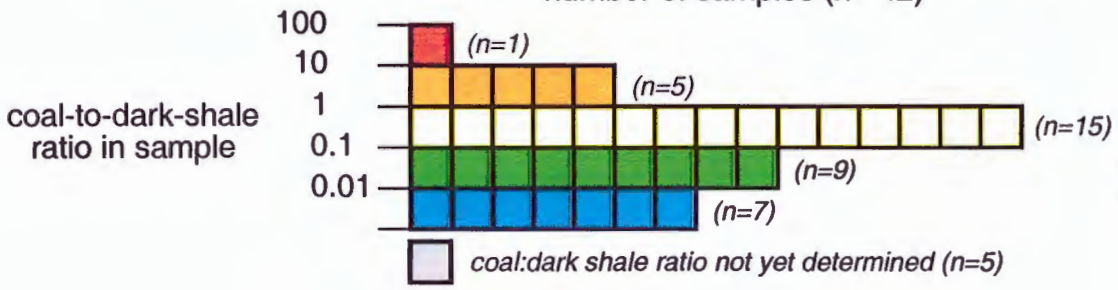


FIGURE 2.

RELATIONSHIP of TOTAL GAS EVOLVED FROM a CUTTINGS SAMPLE to RATE of LOST-GAS
(from 42 cuttings samples from air-drilled wells, Cherokee basin, southeastern Kansas)



number of samples (n= 42)



LOST-GAS ALGORITHM

ccs lost gas = $\sqrt{X}$ (Y)

where X = bottom-hole to canister time (in hours)
where Y = ccs lost gas at 0.36 hours
(i.e., value Y from regression equation)

FIGURE 3.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

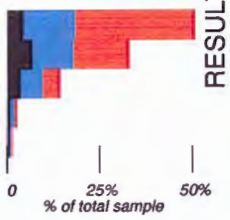
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of ? coal from 1087' to 1090'

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

total gas desorbed
(including estimated lost gas) = 100.6 ccs

TOTAL DRY WEIGHT OF SAMPLE = 227.61 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 118.99 grams (52.3%)
$\text{weight}_{dark\ shale}$ = 76.31 grams (33.5%)
weight_{coal} = 32.31 grams (14.2%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	113.60	8.01% / 28.03% / 63.96%
>0.0661"	73.93	19.55% / 34.59% / 45.86%
>0.0460"	31.86	22.96% / 43.70% / 33.33%
>0.0331"	5.47	16.22% / 60.81% / 22.97%
<0.0331"	2.75	20.00% / 60.00% / 20.00%
	227.61 TOTAL	



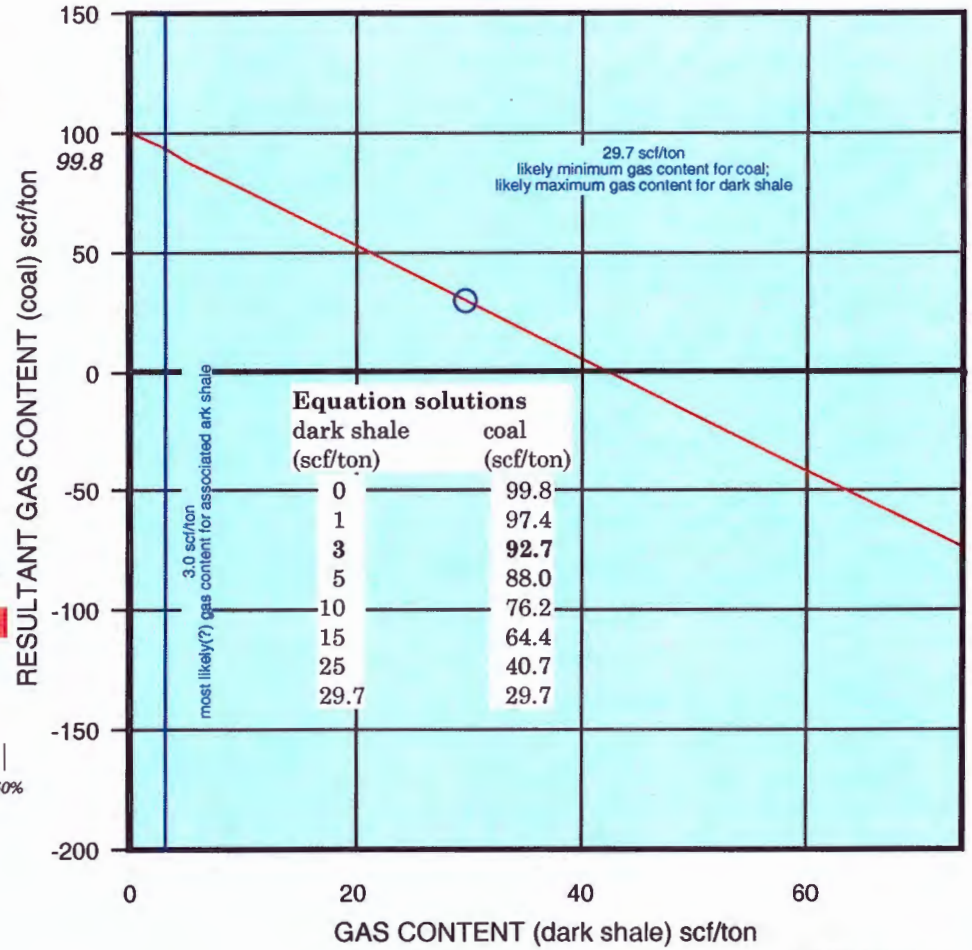


FIGURE 4.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

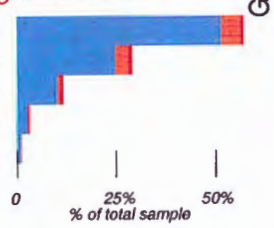
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of black shale from 1114' to 1117'

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

total gas desorbed
(including estimated lost gas) = 151.2 ccs

TOTAL DRY WEIGHT OF SAMPLE = 221.20 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 26.15 grams (11.8%)
$\text{weight}_{dark\ shale}$ = 195.05 grams (88.2%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	124.88	0.00% / 99.06% / 9.94%
>0.0661"	63.09	0.00% / 85.34% / 14.66%
>0.0460"	24.87	0.00% / 86.88% / 13.13%
>0.0331"	6.31	0.00% / 85.45% / 14.55%
<0.0331"	2.05	0.00% / 85.00% / 15.00%
	221.20 TOTAL	



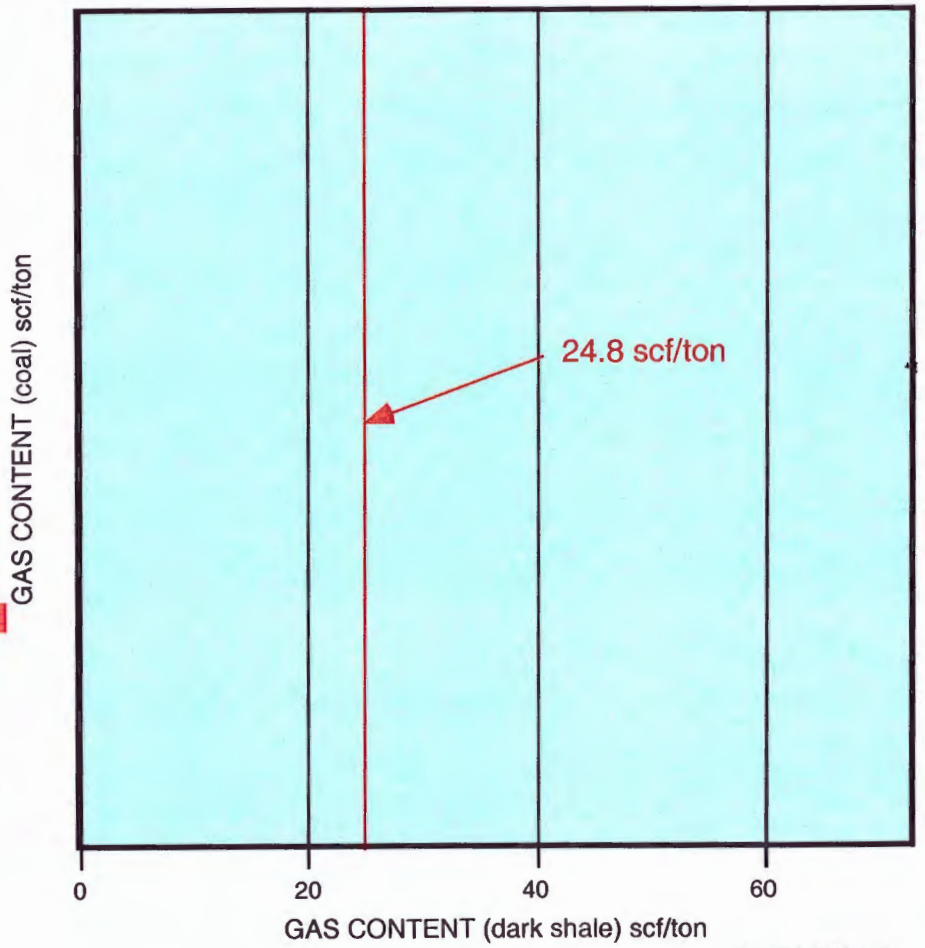


FIGURE 5.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

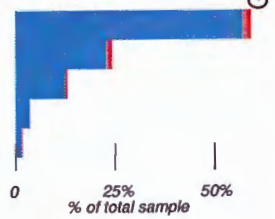
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of shale associated with Bevier coal from 1171' to 1174'

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

total gas desorbed
(including estimated lost gas) = 179.4 ccs

TOTAL DRY WEIGHT OF SAMPLE = 317.43 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 12.29 grams (3.9%)
$\text{weight}_{dark\ shale}$ = 305.14 grams (96.1%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	185.88	0.00% / 96.68% / 3.32%
>0.0661"	75.55	0.00% / 94.37% / 5.63%
>0.0460"	40.22	0.00% / 96.01% / 3.99%
>0.0331"	10.98	0.00% / 98.52% / 1.48%
<0.0331"	4.81	0.00% / 98.00% / 2.00%
	317.43 TOTAL	



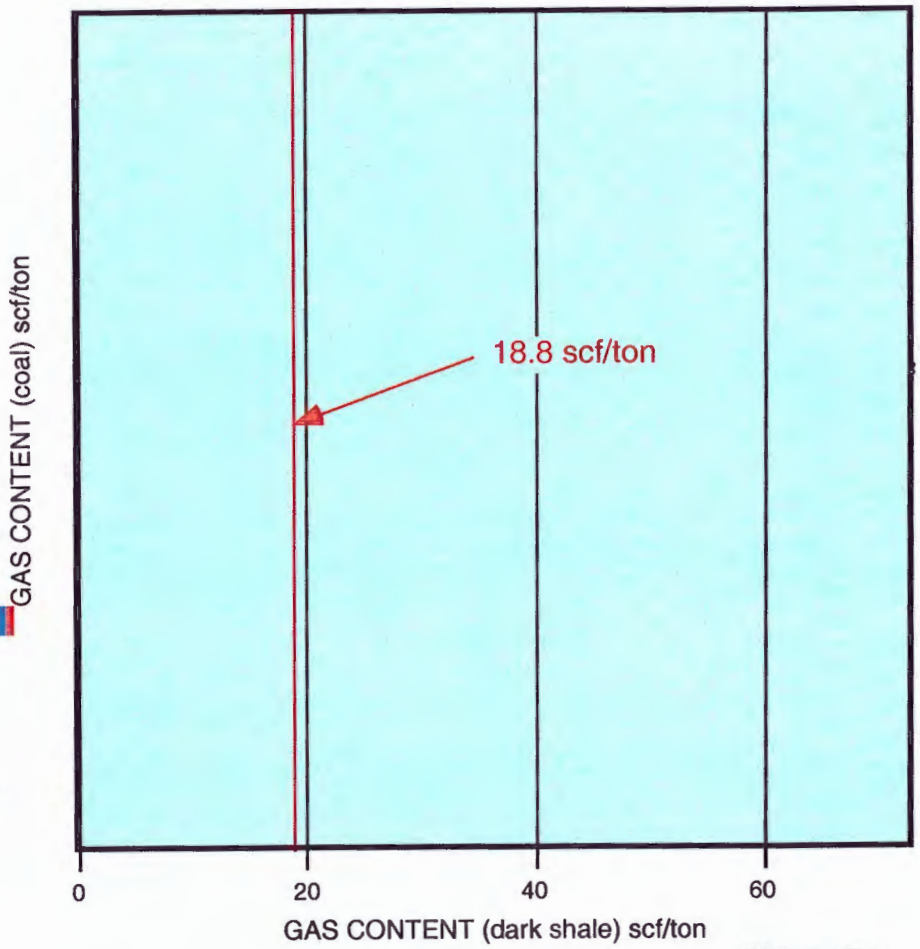


FIGURE 6.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

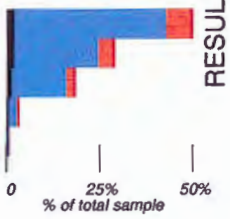
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Croweburg coal from 1185' to 1188'

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

total gas desorbed
(including estimated lost gas) = 1159.3 ccs

TOTAL DRY WEIGHT OF SAMPLE = 669.68 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 96.50 grams (14.4%)
$\text{weight}_{dark\ shale}$ = 541.90 grams (80.9%)
weight_{coal} = 31.28 grams (4.7%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	329.88	3.57% / 81.94% / 14.49%
>0.0661"	190.75	5.93% / 79.23% / 14.84%
>0.0460"	121.50	5.45% / 81.56% / 12.99%
>0.0331"	21.88	5.76% / 76.98% / 17.27%
<0.0331"	5.67	5.00% / 80.00% / 15.00%
	669.68 TOTAL	



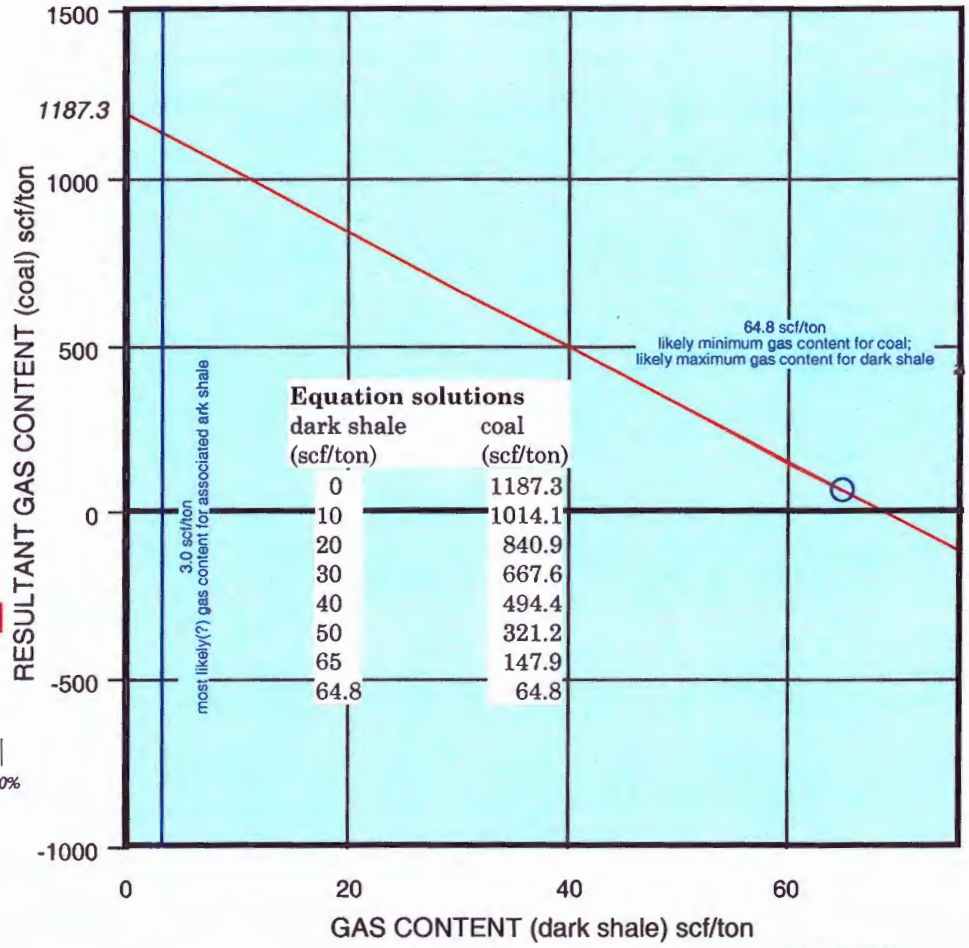


FIGURE 7.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

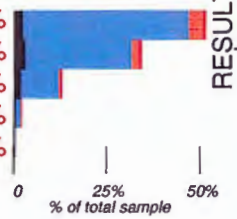
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Tebo coal from 1255' to 1257'

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

total gas desorbed
(including estimated lost gas) = 84.2 ccs

TOTAL DRY WEIGHT OF SAMPLE = 96.12 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 8.00 grams (8.3%)
$\text{weight}_{dark\ shale}$ = 81.73 grams (85.0%)
weight_{coal} = 6.38 grams (6.6%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	48.84	4.04% / 87.02% / 8.94%
>0.0661"	32.49	8.15% / 84.24% / 7.60%
>0.0460"	12.30	12.30% / 80.42% / 7.28%
>0.0331"	2.00	10.00% / 79.00% / 11.00%
<0.0331"	0.50	10.00% / 80.00% / 10.00%
	96.12 TOTAL	



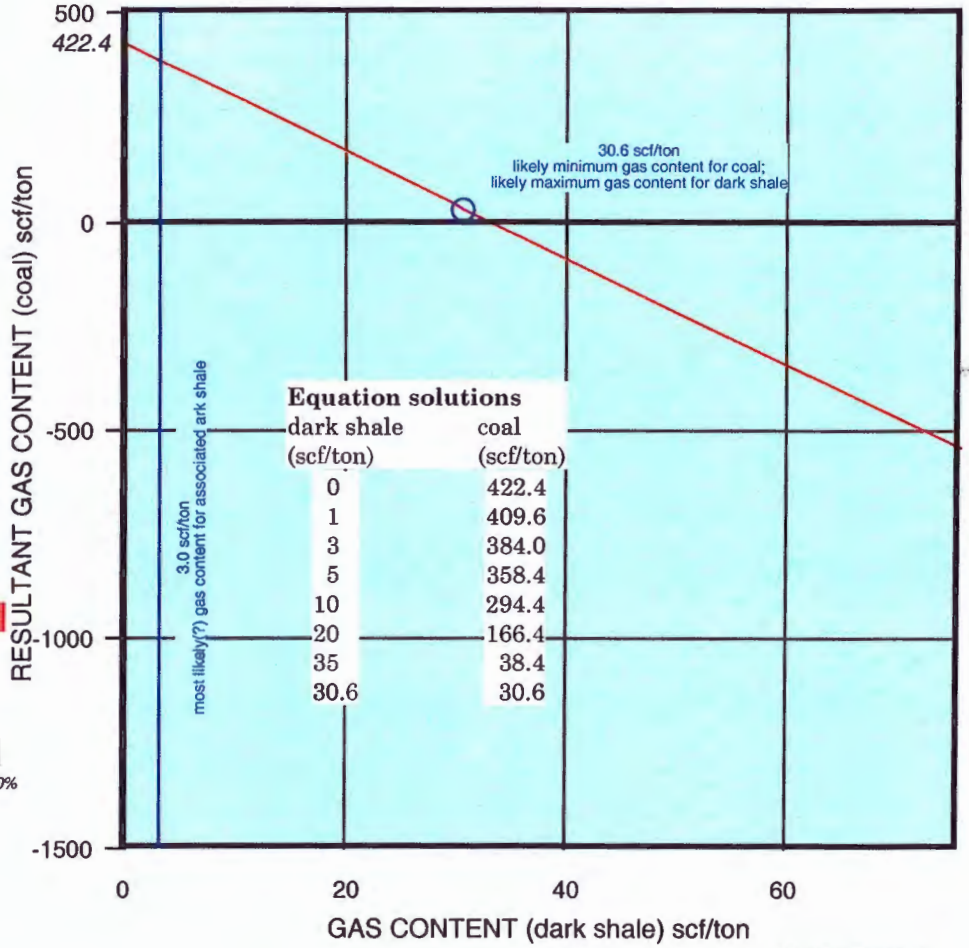


FIGURE 8.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

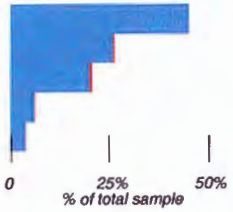
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of shale associated with Weir-Pittsburg coal from 1285' to 1287'

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

total gas desorbed
(including estimated lost gas) = 56.8 ccs

TOTAL DRY WEIGHT OF SAMPLE = 507.56 grams
$\text{weight}_{light\text{-}colored\ lithologies}$ = 5.83 grams (1.1%)
$\text{weight}_{dark\ shale}$ = 501.73 grams (98.9%)
weight_{coal} = 0.00 grams (0.0%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	225.87	0.00% / 100.00% / 0.00%
>0.0661"	131.01	0.00% / 98.60% / 1.40%
>0.0460"	102.42	0.00% / 97.05% / 2.95%
>0.0331"	29.95	0.00% / 97.98% / 2.02%
<0.0331"	18.31	0.00% / 98.00% / 2.00%
	507.56 TOTAL	



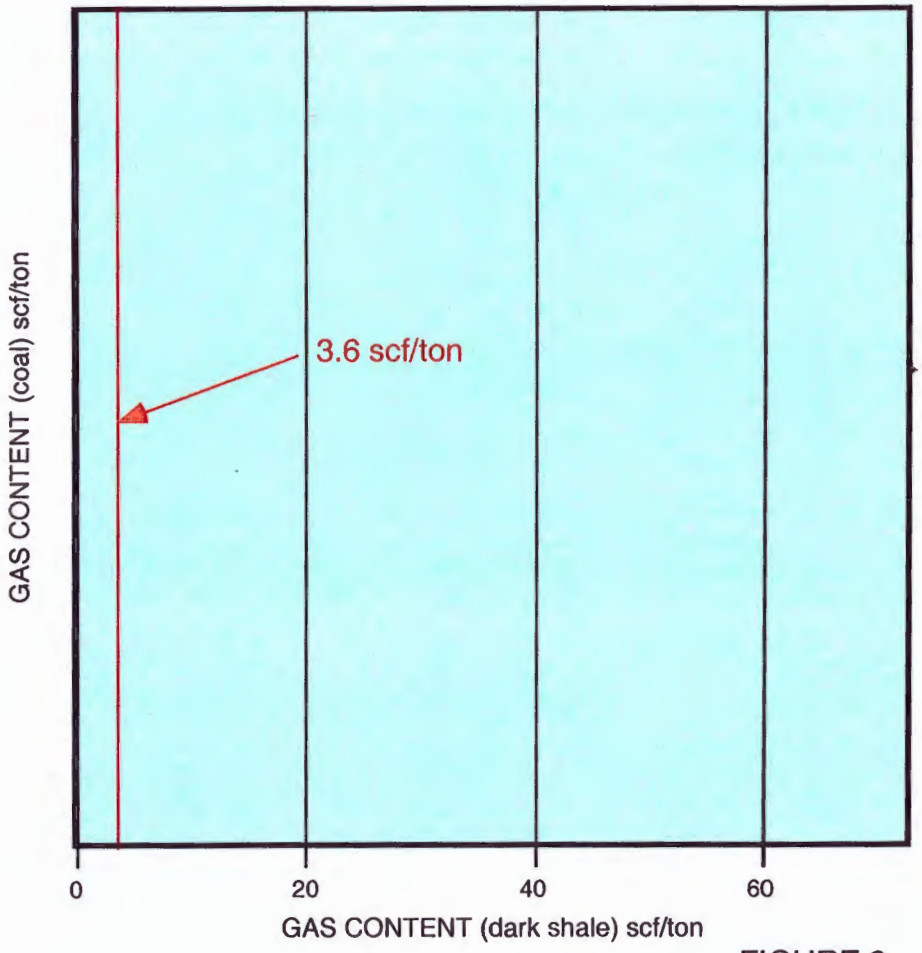


FIGURE 9.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

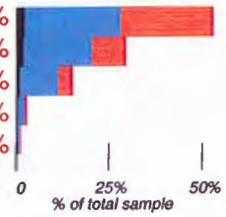
LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for calculation of gas content of Riverton coal from 1466' to 1468'

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

total gas desorbed
(including estimated lost gas) = 149.13 ccs

TOTAL DRY WEIGHT OF SAMPLE = 614.10 grams
$\text{weight}_{\text{light-colored lithologies}}$ = 237.05 grams (38.6%)
$\text{weight}_{\text{dark shale}}$ = 352.08 grams (57.3%)
weight_{coal} = 24.97 grams (4.1%)

sieve size	*grams*	*% coal / % dark shale / % light-colored liths*
>0.0930"	321.24	3.69% / 49.25% / 47.06%
>0.0661"	179.18	5.39% / 63.22% / 31.39%
>0.0460"	92.01	3.56% / 69.66% / 26.78%
>0.0331"	16.06	1.00% / 75.00% / 24.00%
<0.0331"	5.61	0.50% / 79.50% / 20.00%
	614.10 TOTAL	



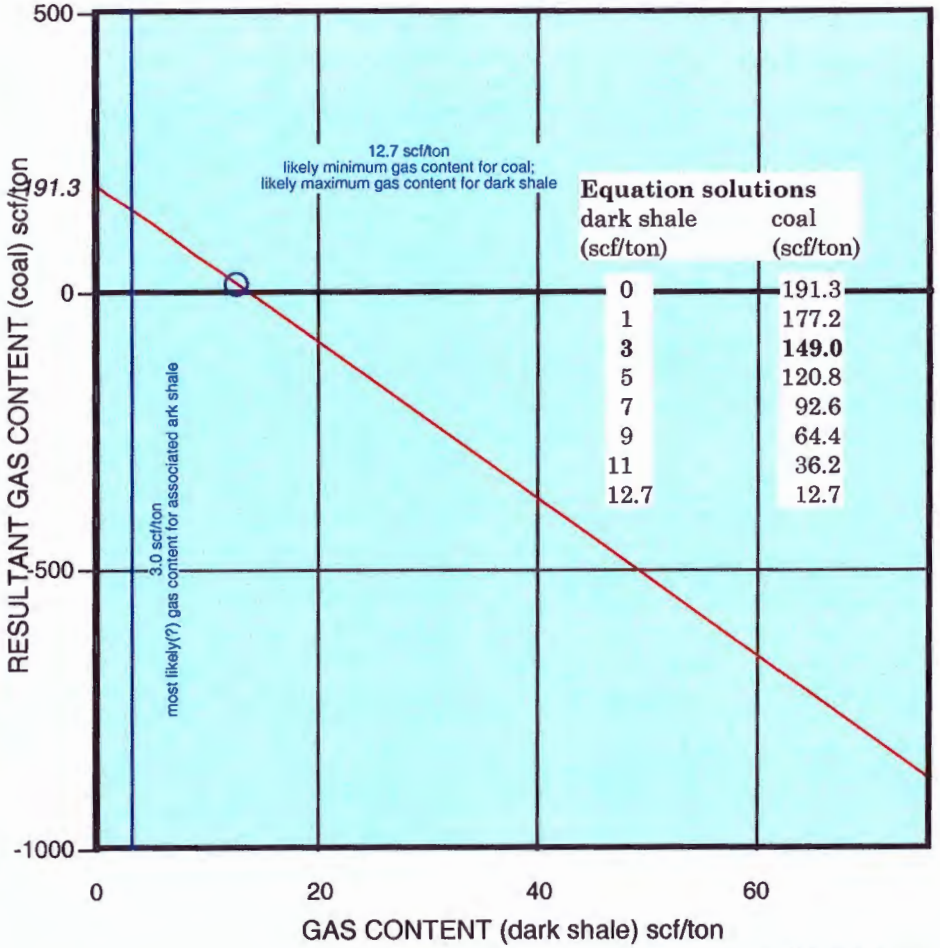


FIGURE 10.

Desorption Characteristics of Cuttings Samples

Dart Cherokee Basin #B4-23 S.F. Huser, W2 SE SE NE 23-T.30S.-R.13E., Wilson County, KS

300'

400'

500'

600'

700'

800'

1000'

1400'

LITHOLOGIC COMPONENT SENSITIVITY ANALYSIS for all samples

UNIT	coal in sample	dk sh in sample	scf/ton w/ shale @ 3 scf/ton	maximum scf/ton	minimum scf/ton
880' Dawson(?)	----	----		*no valid data*	
1087' ? coal	14%	34%	92.7	99.8	29.7
1114' ? black sh.	0%	88%	----	----	24.8
1171' shale w/ Bev.	0%	96%	----	----	18.8
1185' Croweburg	5%	81%	840.9	1187.3	64.8
1255' Tebo	7%	31%	166.4	422.4	30.6
1285' shale w/ W.-P.	0%	99%	----	----	3.6
1466' Riverton	4%	57%	149.0	191.3	12.7
1560' "Mssp top"	----	----		*no valid data*	

scf/ton w/ shale @ 20 scf/ton

880' Dawson(?)

1087' ? coal

1114' ? black shale

1171' sh. w/ Bevier
1185' Croweburg

1255' Tebo

1285' sh. w/ Weir-Pit

1466' Riverton

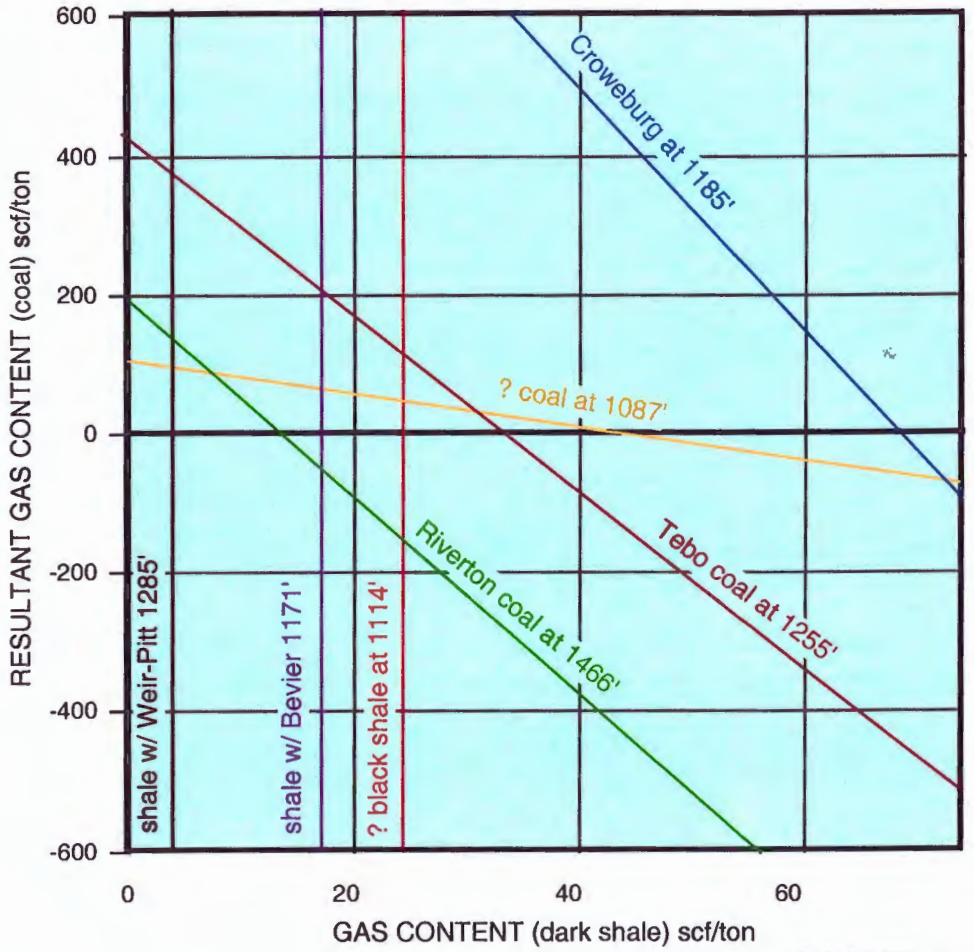


FIGURE 11.