

Attachment "G"
Geologic Data on Injection and Confining Zones
Zelman #1 Injection Well

Formation tops and thickness data were projected utilizing data from offset wells 37-033-20333 and 37-033-20327. The wells are located approximately 1481 feet and 1380 feet north and south of the Zelman #1 well, respectively.

The injection zone is the Huntersville Chert-Oriskany formation. The Huntersville Chert is projected from 7306 to 7358 with a gross thickness of 52'. The Oriskany is projected from 7358 to 7387 with a gross thickness of 29' feet. Fracture Gradient for this formation has been calculated to be .9518 psi/ft. Please see attachment "I" for data and calculations.

The confining zones are the Onondaga Limestone (upper) and the Helderberg Limestone (lower) formations. The Onondaga is projected from 7292 to 7306 with a gross thickness of 14 feet. The top of the Helderberg is projected to be at 7387 to an unknown depth. Fracture data on the Onondaga and Helderberg is unavailable however confinement by these boundaries has been established by Gas Storage in the Oriskany pools throughout Pennsylvania.

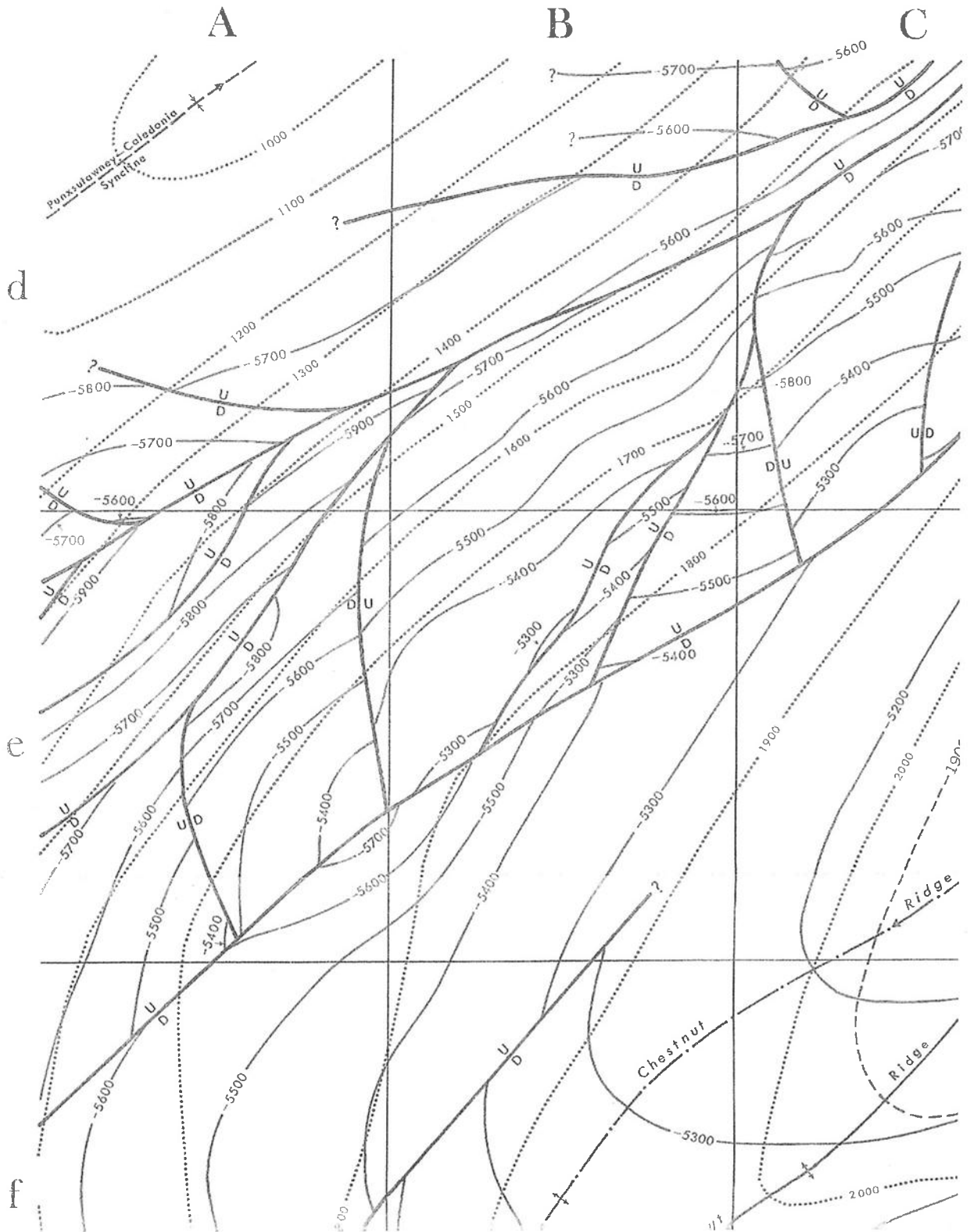
Geologic sample logs were utilized from wells within the Penfield Quadrangle to provide the following lithologic descriptions:

7295-7306	Onondaga Limestone-	Dark gray to black, hard, argillaceous, micro crystalline.
7306-7358	Huntersville Chert –	Dark gray to olive, translucent, argillaceous, micro fractured, dense.
7358-7387	Oriskany Sandstone –	Light gray, fine grained, well cemented quartz sand. Inter-granular porosity with calcite and silica cement.
7387-?	Helderberg Limestone –	Dark gray, micro crystalline, hard, silty, argillaceous.

Published data by the Pennsylvania Geologic Survey on faulting in the area identifies (2) faults within the AOR. (Publication A74 cd -Geology of the Southern Half of the Penfield Quadrangle). Location of these faults are shown on the attached map. Our study confirms the location of the southern fault due to the Onondaga Limestone being displaced by a -397 between wells 37-033-20327 and 37-033-20325. However, we found no data to support the northern fault as shown. Subsurface data from well records from wells 37-033-20341, 20333, 20327, 20336 and 20328 indicate the Onondaga ; Chert and Oriskany formations are in the same block dipping to Northwest. A tabulation of the sub-surface data and well records are attached.

There is substantial data available from the operation of existing storage and production wells drilled into the Huntersville Chert-Oriskany formation that establishes faulting through these formations as traps with definitive boundaries.

PENNSYLVANIA GEOLOGICAL SURVEY



Permit #	Elevation	TD	Tully	Onondoga	Chert	Oriskany	Onon. Sub sea
20325	1628	7637	6638	7616	7635	-	-5988
20341	1633	7365	6712	7281	7296	7351	-5648
20333	1642	7344	6686	7248	7266	7314	-5606
20327	1640	7318	6642	7219	7233	7288	-5579
20336	1544	7271	6610	7195	7213	7269	-5651
20328	1569	7227	6568	7133	7144	7198	-5564

PENFIELD C 206

DM-OG-4-56

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF MINES

1,990' S 41°05'00"
10,200' W 78°42'30" (4)

Oil and Gas Division
HARRISBURG

033-20325-P

LUTHERSBURG
QUADRANGLE: Penfield

7 1/2' 15'

PERMIT NO. CHE-325-P

MAP REFERENCE: 10S 17W S64 W117

KIND OF WELL: Gas Dry
(Oil, Gas, Other)

WELL RECORD

COMPANY: New York State Natural Gas Corporation	Size of Casing and Tubing	Used in Drilling	Left in Well	Packers: Type, Size and Depth
ADDRESS: #2 Gateway Center, Pittsburgh 22, Pa.	13-3/8"	60'	60'	
FARM John R. Potter ACRES 68	9-5/8"	1156'	294'	BHS @ 1152
WELL(FARM)NO. #1 CO. SERIAL NO. N-782	Vent 2"		274'	
ELEVATION: 1627.80 LEASE: 58357				
TOWNSHIP: Brady COUNTY: Clearfield				
DRILLING COMMENCED: 8/7/60 DRILLING COMPLETED: 10/13/60				
PRODUCTION: Dry Hole - Plug and Abandon				PERFORATIONS AT:
ROCK PRESSURE: _____ psig _____ hrs.				
WELL TREATMENT: (Shooting, Acidizing, Fracturing Etc.)				
CEMENTING DATA: (Size Pipe, Depth, No. Bags, Date)				
8/8/60 - 13-3/8" cem. w/50 sacks				
8/11/60 - 9-5/8" cem. @ 1152' w/50 sacks cem. and 15 sacks aquagel				
RESULTS AFTER TREATMENT:				
ROCK PRESSURE AFTER TREATMENT:				

REMARKS:

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Cellar	0	18				
Sand & shale	18	210			FW 50	
Lime & shale	210	220				
Sand & shale	220	255				
Coal or shale	255	265				
Sand	265	319				
Sand & shale	319	409				
Coal	409	415				
Sand & shale	415	2885				
Shale & sand	2885	3295				
Sand & shale	3295	4130	3324 (show)			
Shale & sand shells	4130	4515				
Sand & shale	4515	4922				
Shale & sand	5060	5255				
Sand & shale	5255	5555				
Shale & sand	5555	5907				

(Over)

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Shale & shells	5907	6075				
Sand & shale	6075	6175				
Shale & shell	6175	6637				
Tully lime	6637	6754				
Shale & shells	6754	7617				
Onondaga	7617	7635				
Chert	7635					
Total depth		7637 (In Chert)				
<u>Sample Study</u>						
Tully	6638					
Onondaga	7616					
Chert	7635					

DATE November 15, 19 60

APPROVED New York State Natural Gas Corporation OWNER

BY A. L. Barquist TITLE Superintendent Operations

325-325-P

WUTHERSBURY (1/2)

WELL RECORD

033-20325-P



Name John R Potter #1 Co. Clearfield Twp. Brady No. 3279

2200 from N
2300 from E

Owner NYG A-782 Cont. Date 1638 Elev. Product Drill Wuthebury
Authority Clearfield

Quad. Clearfield

Locate by Sketch

Geol. Name	1912	1960	Thick-ness	From	To	Geol. Name	2200 P S 41-45'	Thick-ness	From	To
AUG 1960	Tully	Onondaga		6639			Moving in rotary 9 5/8" @ 1152			
AUG 1960	Chert	TD		7635	7637					
Sept-1960	PEA	Completed to 1152-60								
	Mauch Chunk			635						
	Catskill			1430	1850					
	Pink rock			2300						

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL RESOURCES

DIVISION OF OIL AND GAS
Room 1205 Kossman Building
100 Forbes Avenue
Pittsburgh, Pennsylvania 15222



CERTIFICATE OF PLUGGING WELL TYPE OF WELL Gas

Torney Winner and Mary Winner
Coal Operator or Owner
218 Wheeler St., Lock Haven, PA 17745
Address

Coal Operator or Owner
Address

Coal Operator or Owner
Address

COMPLETE ABOVE SECTION IF APPLICABLE

Mr. John Gerg
DIVISION REPRESENTATIVE SUPERVISING

Felmont Oil Corporation
Name of Well Operator
P.O. Box 590, Olean, N.Y. 14760
Address

August 15, 1979
Date

Brady Township

Clearfield County

Farm Josephine Carlson, et al

Well (Farm) No. 1 Serial No. F-128

COAL REPRESENTATIVE OBSERVING

We, the undersigned representatives of the well operator certify that we participated in the plugging of the above well, and that the work was started July 31, 1979, and that the well was plugged as follows:

FILLING MATERIAL AND PLUGS	FROM	TO	SIZE	Casing and Tubing	
				PULLED	LEFT
Cast Iron Bridge Plug @ 7250'	7250'	7249'	13-3/8"	--	228'
20 sks. of 50-50 POZ + 10% salt	7249'	7120'	8-5/8"	--	1312'
Gelled water	7120'	2500'	5-1/2"	2500'	4870'
35 sks. of 50-50 POZ + 10% salt	2500'	2400'			
Gelled water	2400'	1750'			
35 sks. of 50-50 POZ + 10% salt	1750'	1650'			
Gelled water	1650'	1350'		Depth of Coal Seam, if Any	
55 sks. of 50-50 POZ + 10% salt	1350'	1175'		186 - 188'	
Gravel	1175'	1160'		329 - 331'	
Air	1160'	Surface			
				Description of Monument	
				2" vent pipe 6' high with 2" tee on top.	
*Unable to cut 5-1/2" casing any lower than 2500' because casing was stuck in hole.					

and that the work of plugging and filling said well was completed on the 8th day of August, 1979.

Felmont Oil Corporation
(Well Operator)

PERMIT NO. 033-20341-P
CE-341-P

PROJECT NO. _____

Michael R. Walls
(Qualified Participant)

Michael R. Walls
(Qualified Participant)

(Qualified Participant)

One copy of this certificate to be mailed to each coal operator or owner, if any, and one to the Division, by registered mail, upon completion of plugging.

19

Du Bois F 23

14,500' S 41° 07' 30"
550' W 78° 45' 00"

(3)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF MINES AND MINERAL INDUSTRIES
OIL AND GAS DIVISION

033-20341-P
Coal seams un-workable
~~625-344-P~~

ANGLE: DuBois 7 1/2' 15'
Sec. "F"

PERMIT NO. ~~No permit issued~~

MAP REFERENCE: 29,650' S/NL
550' W/EL

KIND OF WELL: Gas
(Oil, Gas, Other)

WELL RECORD

COMPANY:	Size of Casing and Tubing	Used in Drilling	Left in Well	Packers: Type, Size and Depth
Felmont Oil Corporation	13 3/8"	228.22'	228.22'	
ADDRESS: P. O. Box 354, Bradford, Penna.	8 5/8"	1312.00'	1312.00'	
FARM Josephine Carlson, et al ACRES 48	5 1/2"	7370.22'	7370.22'	
WELL FARM NO. 1 CO. SERIAL NO. F-128 Sylvania #6972				
ELEVATION: 1644' RT LEASE: FPaL-9673				
TOWNSHIP: Brady COUNTY: Clearfield				
DRILLING DRILLING				
COMMENCED: 11/1/60 COMPLETED: 11/26/60				
PRODUCTION: 4,150,000 cu. ft.				PERFORATIONS AT:
ROCK PRESSURE: 2839 psig. 20 hrs.				
WELL TREATMENT: (Shooting, Acidizing, Fracturing Etc.)				
11/25/60 - Halliburton hydrafrac from 7299' - to 7365' with 11,900 gal. frac fluid; propping agent 9,000# 20-40 sand, 3,500# 10-30 sand; 1,000 gal. MCA acid; 500# WGr-4 gel agent; 200# CW-1 breaker agent; 30 gals. Howco da; 3,500# sand; Max. pressure: 4500#.				CEMENTING DATA: (Size Pipe, Depth, No. Bags, Date)
RESULTS AFTER TREATMENT: 15,000,000 cu. ft.				11/6 - Set 13 3/8" drive pipe @ 230' with 175 sacks of Regular cement.
ROCK PRESSURE AFTER TREATMENT: 2810# - 72 hrs.				11/9 - Set 8 5/8" casing @ 1320' with 375 sacks of Regular cement.
				11/18 - Set 5 1/2" casing @ 7299' with 125 sacks of Regular cement and 40 sacks of Aqualgel.

REMARKS: Gas Tested At:
7355' - 2,500,000 cu. ft.
7360' - 3,200,000 cu. ft.
7365' - 4,150,000 cu. ft.

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Clay	0	40				
Shale	40	107			107' (fresh)	
Sandy Shale	107	186				
Coal	186	188				
Shale	188	243			200' (fresh)	Set 13 3/8" @ 230'
Sand - Water Sand	243	248				
Sand & Shale	248	268				
Sand	268	280			275' (fresh)	
Shale	280	304				
Sand	304	308				
Shale	308	329				
Coal	329	331				

(OVER)

033-20341-P

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Shale	331	417				
Coal	417	419				
Sand	419	423				
Sand & Shale	423	471				
Shale	471	485				
Sand & Shale	485	505				
Shale	505	515				
Sand	515	520				
Sand & Shale	520	524				
Sand	524	554				
Sand & Shale	554	561				
Sand	561	630				
Sand & Shale	630	675				
Sand	675	735				
Sandy Shale	735	760				
Sand	760	804				
Little Red	804	810				
Sandy Shale	810	890				
Sand & Shale	890	945				
Shale	945	965				
Sand w/little shale	965	1020				
Sandy Shale	1020	1025				
Sand	1025	1050				
Sand streak red rock	1050	1055				
Sand	1055	1060				
Sandy shale	1060	1075				
Sand	1075	1090				
Shale	1090	1100				
Sand	1100	1125				
Shale	1125	1130				
Sandy Shale	1130	1150				
Shale	1150	1155				
Sandy shale	1155	1165				
Sand	1165	1180				
Sandy Shale	1180	1225				
Sand	1225	1260				
Sand & Shale	1260	1280				
Sand	1280	1290				
Shale	1290	1300				
Sandy Shale	1300	1320				Set 8 5/8" @ 1320'
Sandy Shale	1320	1710				
Shale	1710	1780				
Red rock & Shale	1780	1790				
Sandy Shale	1790	1830				
Sandy red rock	1830	1835				
Sandy Shale	1835	1848				
Red rock	1848	1854				
Sandy shale	1854	2550				
Sand	2550	2640				
Sandy Shale	2640	2710				
Sand	2710	2820				
Sandy Shale	2820	2900				
Shale	2900	3040				

Date January 12, 19 61APPROVED FELMONT OIL CORPORATION, OwnerBy *W. H. Johnson*
(Title) Vice President

*File under
DuBois Nat'l Bank*

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF MINES

Oil and Gas Division
HARRISBURG

083-20333

QUADRANGLE: Lehigh Valley
Penfield

7 1/2' 15'

PERMIT NO. CLB-999

MAP REFERENCE: 9S 17W S63 W117 & 118

KIND OF WELL: GAS
(Oil, Gas, Other)

WELL RECORD

COMPANY:	Size of Casing and Tubing	Used in Drilling	Left in Well	Packers: Type, Size and Depth
New York State Natural Gas Corporation	13 3/8"	96'	96'	
ADDRESS: 2 Gateway Center, Pgh. 22, Penna.	9 5/8"	1285'	1285'	BHS @ 1287
FARM * <u>H. E. Ginter Est.</u> ACRES <u>172</u>	7"	7335'	7335'	BHS @ 7267
WELL (FARM) NO. <u>1</u> CO. SERIAL NO. <u>N-796</u>				
ELEVATION: <u>1642.34</u> LEASE: <u>60986</u>				
TOWNSHIP: <u>Brady</u> COUNTY: <u>Clearfield</u>				
DRILLING COMMENCED: <u>12-1-60</u> DRILLING COMPLETED: <u>12-23-60</u>				
PRODUCTION: <u>10,504,000</u> cubic feet				PERFORATIONS AT:
ROCK PRESSURE: <u>2340</u> psig <u>70</u> hrs.				
WELL TREATMENT: (Shooting, Acidizing, Fracturing Etc.)				
<u>12-22-60-Fractured w/20,000 gals. water, 200 lb. gel, 1,000 gal acid and 20,000 lb sand. Break-</u>				
<u>in pressure 3000 lbs; maximum pressure 3750 lbs</u>				
<u>Final open flow of 48,000 cubic ft. in chert</u>				
<u>3825,000 cubic ft. in Oriskany increased to</u>				
<u>4,05,000 cubic ft. A/F. R.P. b/f 2450 lbs</u>				
<u>24 1/2 hrs. dead weight.</u>				
RESULTS AFTER TREATMENT:				
ROCK PRESSURE AFTER TREATMENT:				

CEMENTING DATA: (Size Pipe, Depth, No. Bags, Date)

12-3-60 - 13 3/8" cem. w/90 sax
12-7-60 - 9 5/8" cem. @ 1287 w/50 sax cem & 20 sax aquagel
12-16-60 - 7" cem @ 7267 w/125 sax

REMARKS: * Well Permit Request and all initial Records Referred to this Well as "DuBois Deposit National Bank Trustee Etal". They are in fact Successor Trustee Under the Henry E. Ginter Deed of Trust. In the Interest of Brevity, We have Established and are Using the Farm Name as Recorded Above.

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Surface	0	5				
Sand & shale	5	105				
Shale & Sand	105	150				
Sand & Shale	150	340				
Coal	340	345				
Sand & Shale	345	375				
Shale & Sand	375	468				
Coal	468	474			458	
Shale & Sand	474	532				
Sand & Shale	532	735				
Sand	735	785				
Sand & Shale	785	1720				
Shale & Sand	1770	2165				
Sand & Shale	2165	4310	3385-92 (Show)			
Sand & Shale	4310	5170				
Shale & sand	5170	5405				
Sand & Shale						

(Over)

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Shale & Shells	5405	6150				
Sand & Shale	6150	6425				
Shale & Shells	6425	6686				
Lime	6686	6784				
Shale & Shells	6784	7248				
Lime	7248	7266				
Chert	7266	7314	7267 & 7300			
Sand	7314	7343	7316-25			
Lime	7343					
Total Depth		7344				
<u>Sample Study</u>						
Tully	6686					
Onondaga	7248					
Chert	7266					
Oriskany	7314	7343				

DATE January 24, 1961

APPROVED New York State Natural Gas Corporation, OWNER

BY: A. R. Sawyer
TITLE
Superintendent Operations

WELL RECORD 033-20333

Name DuBais Nat Bank (1/2) H.F. Winter Co. Clearfield Twp. Brady No. 3351
 Owner NYSEG Corp N. 796 Contr. H. Winter
 Date _____ Elev. 1642 Product _____
 Obtained by _____ Authority Drill Quad. Clearfield D 1

295°
~~37 20°~~ From N.
~~32 50°~~ From E
 2240'

Geol. Name	Thickness	From	To	Geol. Name	Thickness	From	To
OCT 21 1960				800 600 ft E 78 45			
OCT 28 1960							
Dec 16		Tully	6689	7 3/8" casing @ 1287 ft			
		Onondaga	7248	7" " 7267 ft			
		chert	7266				
		Oriskany	7343				
		TD	7344				
		3875 Mcf BF			14		
		RP 2390 psi 16 hrs.					
Dec 30		10,504 Mcf gas AF					
		RP 2340 psi 70 hrs.					
		Completed 12-30-60					
		Gas - 7267 @ 7300					
		7316 - 25					

Locate by Sketch

Pennsylvania - Driftwood Field
Helvetia Pool

1,850' S 41° 05' 00"
11,050' W 78° 42' 30" (4)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF MINES

Oil and Gas Division
HARRISBURG

033-20327

LUTHERSBURG
QUADRANGLE: ~~Penfield~~

7 1/2' 15'

PERMIT NO. ~~GLE 727~~

MAP REFERENCE: 9S 17W S63 W117

KIND OF WELL: Gas
(Oil, Gas, Other)

WELL RECORD

COMPANY: New York State Natural Gas Corporation	Size of Casing and Tubing	Used in Drilling	Left in Well	Packers: Type, Size and Depth
ADDRESS: #2 Gateway Center, Pittsburgh 22, Pa.	13-3/8"	59'	59'	
FARM: John R. Potter ACRES 68	9-5/8"	1251'	1251'	BHS @ 1248'
WELL(FARM)NO. 2 CO. SERIAL NO. N-790	7"	7305'	7305'	BHS @ 7234'
ELEVATION: 1640.60 LEASE: 58357				
TOWNSHIP: Brady COUNTY: Clearfield				
DRILLING COMMENCED: 8/31/60 COMPLETED: 9/29/60				
PRODUCTION: 30,370,000 cubic feet				PERFORATIONS AT:
ROCK PRESSURE: 3293 psig 4 days. xxxx				
WELL TREATMENT: (Shooting, Acidizing, Fracturing Etc.)				
9/27/60 - Fractured w/20,500 gals. water, 1,000 gal. MCA, 150 lbs. gel and 20,000 lbs. sand. breakdown pressure 2400 lbs.; maximum pressure 4800 lbs; minimum pressure. 2350 lbs.; final pressure 3800 lbs. Original open flow of 7,312,000 cubic feet increased to 30,370,000 cu. ft. a/f Rock pressure b/f 3318 lbs. in 11 days				
CEMENTING DATA: (Size Pipe, Depth, No. Bags, Date)				
				8/31/60 - 13-3/8" cem. @ 70' w/50 sacks
				9/4/60 - 9-5/8" cem @ 1248' w/50 sacks cem., 15 sacks aquagel, & 25 sacks quadroflos
RESULTS AFTER TREATMENT:				
ROCK PRESSURE AFTER TREATMENT:				9/13/60 - 7" cem. @ 7234' w/125 sacks.

REMARKS:

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Surface	0	15				
Sand & shale	15	143			FW 75'	
Red shale	143	146				
Sand & shale	146	205				
Coal	205	209				
Sand & shale	209	217				
Shale & sand	217	303				
Coal or black shale	303	306				
Shale & sand	306	320				
Shale	320	340				
Sand	340	550				
Shale & sand	550	580				
Sand	580	650				
Shale & sand	650	692				
Sand	692	733				
Red shale	733	735				

(Over)

Well N 790

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Sand & shale	735	1010				
Black shale	1010	1020				
Sand & shale	1020	2293				
Shale	2293	2295				
Shale & sand	2295	2601				
Sand & shale	2601	3415				
Shale & sand	3415	4015				
Sand & shale	4015	5025				
Shale & sand	5025	5475				
Sand & shale	5475	5680				
Shale & sand	5680	5857				
Sand & shale	5857	6030				
Lime & shale	6030	6137				
Lime	6137	6195				
Shale & shells	6195	6642				
Lime	6642	6750				
Shale & shells	6750	7219				
Onondaga lime	7219	7233				
Chert	7233	7288				
Sand	7288	7317	7291-7303			
Lime	7317					
Total Depth		7318				
<u>Sample Study</u>						
Tully	6642					
Onondaga	7219					
Chert	7233					
Oriskany	7288	7317	7291-7303			

RECEIVED
DEPT. OF MINES
& MINERAL IND.

1960 NOV 29 AM 8:44

DATE October 28, 19 60

APPROVED New York State Natural Gas Corporation OWNER

BY

D. B. Bangs

TITLE

Superintendent of Operations

LUTHERSBURG (7 1/2) WELL RECORD 033-24327

Name John R. Potter #2 Co. Clearfield Twp. Brady No. 3293
 Owner NYSNG Corp N-790 Contr. UVSTEP
 Date 11/17/60 Elev. 1640.6 Product _____ Drill LUTHERSBURG
 Obtained by _____ Authority _____ Quad. Lebanon 63

2000' from N
23800 fr E

Locate by Sketch

Geol. Name	Thick-ness	From	To	Geol. Name	Thick-ness	From	To
Sept 2, 1960				200 ft E 78' 45'			
Sept 16							
Tully		6642		7 5/8" casing at 1250'			
Onondaga chert		7219		7" casing at 7234 ft			
Oriskany		7288	7317	Sept 23 SD to frac			
7300 Mof gas BF			7318				
TD							
RP 3342 # 56 hrs							
SEP 20 1960 30,370 Mof gas							
RP 3800 #							
Completed 9-29-60							

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF MINES AND MINERAL INDUSTRIES
OIL AND GAS DIVISION

1.300° S 41° 05' 00"
2.000° W 78° 45' 00" (F)

033-20336

QUADRANGLE: DuBois "7" 7 1/2' 15'

PERMIT NO. GLE 336

MAP REFERENCE: 1350 NL 2100 EL

KIND OF WELL: Gas
(Oil, Gas, Other)

WELL RECORD

COMPANY:	Size of Casing and Tubing	Used in Drilling	Left in Well	Packers: Type, Size and Depth
<u>Lee E. Minter</u>				
ADDRESS: <u>9 Florence St. Bradford, Pa.</u>	<u>20"</u>	<u>19.60'</u>	<u>19.60'</u>	
FARM: <u>T.W. Chapman (Little Times Square)</u> <u>ACRES POOL</u>	<u>13 3/8"</u>	<u>218.08'</u>	<u>218.08'</u>	
WELL (FARM) NO. <u>1</u> GO. SERIAL NO. _____	<u>9 5/8"</u>	<u>1190.03'</u>	<u>1190.03'</u>	
ELEVATION: <u>1544</u> LEASE: _____	<u>5 1/2"</u>	<u>7199'</u>	<u>7199'</u>	
TOWNSHIP: <u>Brady</u> COUNTY: <u>Clearfield</u>				
DRILLING COMMENCED: <u>12/20/61</u> DRILLING COMPLETED: <u>1/13/61</u>				
PRODUCTION: <u>1,200 MCF</u>				PERFORATIONS AT:
ROCK PRESSURE: <u>2229</u> psi/g <u>27 1/2</u> hrs				
WELL TREATMENT: (Shooting, Acidizing, Fracturing Etc.) <u>Hydrofrac 2/2/61</u>				
	CEMENTING DATA (Size Pipe, Depth, No. Bags, Date)			
	<u>20"</u>	<u>19.60'</u>	<u>15 sacks</u>	<u>12/20/60</u>
	<u>13 3/8"</u>	<u>218'</u>	<u>215 Sacks</u>	<u>12/21/60</u>
RESULTS AFTER TREATMENT: <u>5,876 MCF</u>	<u>9 5/8"</u>	<u>1190'</u>	<u>50 Sacks</u>	<u>12/24/60</u>
ROCK PRESSURE AFTER TREATMENT: <u>2,069# 66Hrs</u>	<u>5 1/2"</u>	<u>7199'</u>	<u>150 sacks</u>	<u>1/10/61</u>

REMARKS:

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
Sand	0	22				
Sand & shale	22	143			82' fresh	
White sand	143	173				
Coal	173	176				
Sand	176	180				
Sand & shale	180	197				
Coal	197	203				
Sand	203	211				
Sand & shale	211	360				
Coal or black shale	360	380				
Sand	380	395			405' fresh	
Coal or black shale	395	410				
Sand	410	470				
Sand & shale	470	595				
Sand	595	820				
Red Rock	820	842				

(over)

FORMATION	TOP	BOTTOM	GAS AT	OIL AT	WATER AT (Fresh or Salt Water)	REMARKS
sand	842	870				
sand & shale	870	895				
sand & shale break	975	1065				
sand & shale	1065	5715	2825-2835'			Est. 582 MCF
shale & shell Gray	5715	6216				
shale & shell Brown	6216	6624				
lime Tully	6624	6724				
shale & shell	6724	7195				
lime	7195	7213				
chert	7213	7269				
sand Oriskany	7269	7282	T D 7271'			

Date February 15, 1961

APPROVED *W. E. Winter*, Owner

By _____ (Title)

033-20336

WELL RECORD

Log: 10-7214

1350' S N
2100' E

Name T.W. Chapman Co. Clearfield Twp. Brady No. 3359
 Owner MYSNG Corp et al Contr. Helvetia Outstep
 Date _____ Elev. 1544 Gr. _____ Product _____ Drill _____
 Obtained by 1554 DFAuthority Quad. DuBois J 26 Locate by Sketch

Geol. Name	Thick-ness	From	To	Geol. Name	Thick-ness	From	To
Dec 9 1960							
	6100	10					
13-61 Tully		6620	6715				
Onondaga		7195					
chert		7213					
Oriskany		7269					
T.D. in Oriskany T.D.			7288	1-20-61			
858 Mcf gas BF							
20-61 1200 Mcf gas BF @	7271	1-74					
R.P. 2229 # 27 hrs					7269		
10-61 5876 Mcf gas Mcf AF					1554		
R.P. 2069 # 66 hrs AF					5715		
From Gamma log							
Tully		6610	6715				
Brush		7195					
Completed 2-4-61							

Attachment "H"
Operating Data
Zelman#1 Injection Well

The proposed operating rates and volumes are based on:

- (A) Previously accepted fracture gradients for the Chert/Oriskany formations by the EPA. (See attached EPA correspondence)
- (B) Calculations from data obtained during an injectivity test performed on Dannic Energy's Green Glenn #1 well located in Huston Twp, Clearfield County. (See Green Glenn #1 Injection test data and calculations)
- (C) Calculations from reported fracture treatment data on offsets to the proposed Zelman #1 injection well. (See attachment "I" for calculation)

1. Proposed Average Daily Injection Rate: 2000 bbls/day
Proposed Average Daily Injection Volume: 2000 bbls
Proposed Average Injection Pressure (Bottom Hole): 5500 psi

Proposed Maximum Daily Injection Rate: 2296 bbls/day
Proposed Maximum Daily Injection Volume: 2296 bbls
Proposed Maximum Injection Pressure: (Bottom Hole): 6575 psi

2. The nature of the annulus fluid will be fresh water with corrosion control additives. Corrosion inhibitor will be Alpha 2278W added at a rate of 2.5 gallons/1000 gallons of water.

3. Source of Injected fluid.

The injected fluid will be brines and produced fluids associated with the production of oil and gas. The source of the fluid will be produced fluids from oil & gas operators registered with the Pennsylvania Department of Environmental Resources.

The following four types of fluids will be disposed of at the facility:

Excessive surface waters encountered during drill operations

Produced fluids from shallow upper Devonian wells

Produced fluids from Marcellus wells

Produced fluids from Oriskany wells

4. Analysis of Injected fluid.

Attached are analyses of representative samples for each type of fluid to be disposed of at the facility. Additional analyses are attached of Marcellus drill pit and flow back fluids provided by a potential client.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION III

841 Chestnut Building
Philadelphia, Pennsylvania 19107

MAR 13 1990

Mr. Ross Ashcom
Senior Staff Engineer
CNG Development Co.
One Park Ridge Center
P.O. Box 15746
Pittsburgh, PA. 15244

Dear Mr. Ashcom:

I have reviewed your letter of March 8, 1990 and the facsimile transmitted to this office on March 13, 1990, which request that an increase in the maximum injection pressure be allowed during CNG's planned injectivity test to be conducted on the Morris Critchfield Well #1 located in Jenner Township, Somerset County, PA.

The hydraulic fracturing data, submitted for the well mentioned above, agrees with similar data provided earlier for other wells in the immediate area drilled to the Oriskany. I agree that the use of a fracture gradient of 0.90 psi/ft. for the Oriskany is acceptable. Therefore, based on the following calculation, CNG will be permitted to inject up to a maximum injection pressure of 3218 psi during the injectivity test.

$$\begin{aligned} P_{max} &= [\text{Frac. Grad.} - (.433 \times \text{Spec. Grav.})] \times \text{Depth} \\ &= [0.90 - (.433 \times 1.2)] \times 8469 \\ &= 3218 \text{ psi} \end{aligned}$$

If you should have any questions, please give me a call at (215) 597-2537.

Sincerely,

S. Stephen Platt
UIC-Section (3WM43)
DW/GW Protection Branch

cc: Dave Rectenwald

THE PEOPLE NATURAL GAS COMPANY
REPORT ON HYDRAULIC FRACTURING

Well No. 4206

Map N E

1. Farm Name: Moris Critchfield Township: Jenner County: Somerset
2. Operator: Felmont Oil Corporation and Peoples Natural Gas Company
3. Sand Fraced: Chert & Sand T. Sand: 8,397, B. Sand: 8,540, T. Pay ?
4. Open Flow before fracing: 350 Mcf, Rock Pressure before fracing: N.T.#
5. Open Flow after fracing and cleanout: 5,030 Mcf, Rock Pressure after fracing: 3,590#. 7 days.
6. Surveys on well before fracing: Temp: Caliper: Gamma Ray:
Other
7. Date well fraced: February 14, 1959
8. Size Tubing: 7" Length: 8,397'
9. Type Packer: On shoe Set at 8,397 feet, was packer cemented? Yes, 150 sacks
10. Fracing solution (kerosene, crude oil, etc.): Water Amount: 37,000 Gals.
11. Breakdown (or max.) pressure: 3,200 # Time required to breakdown: 2 Min.
12. Amount gel: 20,000 Gals Amount sand: 20,000 pounds
13. Pump pressure while pumping gel: 3,200 to 4,000 pounds
14. Injection rate from time starting gel: 1,344 gallons per minute
15. Amount gel breaker: None
16. Fluid recovered after fracing: None
17. Sand recoverd after fracing: None
18. New Well: X Drill Deeper: Old Well:
19. Was fraced sand ever shot? No
20. Service Company: Halliburton Oil Well Cementing Co.
21. Remarks:

Reported by: P. H. Reefer

Date: 2-18-59

Surface Breakdown Pressure = 3200 psia
 (From PNG Report)

Gravity of Fluid = 1.2
 10 lb./gal.
 (Assumed)

Depth of Formation (ft). = 8469
 (PNG Report)

Bottomhole Breakdown Pressure = $P_{\text{surface}} + P_{\text{hydrostatic}}$
 = $3200 + 1.2 (.433) (8469)$
 = 7600 psi

Frac Gradient = $7600/8469 = 0.9$ psi/ft.

Proposed Injection Pressure = $P_{\text{bd}} - P_{\text{h}}$
 = $(.9 - .52)8469 = 3200$ psia

Frictional Pressures*

<u>Pump Rate (BPM)</u>	<u>Pressure Loss per 1000' of 2 7/8" Tubing (PSI/1000')</u>	<u>Pressure Loss 8400' of 2 7/8" Tubing (PSI)</u>
1	20	168
2	34	286
3	65	546
4	110	924
5	155	1,302

*These pressure losses could theoretically be added to the 3200 psi surface pressure calculated without breakdown.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

Region III - 6th & Walnut Sts.
Philadelphia, Pa. 19106

SUBJECT: Amoco/Danson West Shanksville, PA.
Disposal Well

DATE: OCT 26 1984

FROM: Charles Kleeman *Chark*
PA Implementation Section
Water Supply Branch

TO: File

Amoco Production Company has recently conducted two step-rate tests on their Somerset County disposal well at the request of Danson Oil Company, potential purchaser of the well.

The tests were performed on September 27 and October 15, 1984 and yielded fracture gradients of 0.907 and 0.905 psi/ft respectively. Relevant test data follows:

Date of Test	9/27/84	10/15/84
Fluid Density (lbs/gal)	9.9	10.4
I.S.I.P. (psi)	3500	3250
Depth	88912	88912
Fracture Gradient	0.907	0.905

The I.S.I.P. valves were read off of the Halliburton test chart by myself and Steve Platt.

The question of whether these test results compare favorably with data in the PA. DER permit application which reported an ISIP of 4000 psi is resolved if one assumes a fluid density of about 8.5 lbs/gal for "gelled water" as reported in the DER application. These data yield a fracture gradient of 0.890 psi/ft, which is very close to the results of the recent step rate tests.

The formula used is:

$$F.G. (psi/ft) = \frac{\text{Fluid Density } (\#/gal) \times 0.052 \frac{(psi/ft)}{(\#/gal)} \times \text{Depth (ft)} + \text{ISIP (ps)}}{\text{Depth (ft)}}$$

cc: Jon Capacasa
Steve Platt

10/26/84

W. SHANKSVILLE SALT WATER DISPOSAL WELL

DEPTH.	9044'
PERFORATED INTERVAL	8825-9000'
ASSUMED INJECTION INTERVAL	8898-8938'
MIDPOINT INJECTION INTERVAL	8920'
EST. AVG. DENSITY OF INJECTION FLUID	± 9.9 #/GAL
DER APPROVED SURFACE PRESSURE LIMITATIONS	3900 PSI
HYDROSTATIC HEAD OF INJECTION FLUID	± 4592 PSI
MAXIMUM BOTTOM HOLE INJECTION PRESSURE	± 8492 PSI
MAXIMUM APPROVED INJECTION GRADIENT	.952 PSI/FT
INSTANTANEOUS SURFACE SHUT-IN PRESSURE (9/27/84)	3500 PSI
HYDROSTATIC HEAD OF DISPLACING FLUID (9.9 PPG)	4592 PSI
INSTANTANEOUS BOTTOM HOLE SHUT-IN PRESSURE	8092 PSI
CALCULATED FRAC GRADIENT	.907 PSI/FT
INSTANTANEOUS SURFACE SHUT-IN PRESSURE (10/15/84)	3250 PSI
HYDROSTATIC HEAD OF DISPLACING FLUID (10.4 PPG)	4824 PSI
INSTANTANEOUS BOTTOM HOLE SHUT-IN PRESSURE	8073 PSI
CALCULATED FRAC GRADIENT	.905 PSI/FT

Injectivity Test Data and Calculations for Green Glenn #1 well:

An Injectivity Test was conducted on the Green Glenn # 1 Well (Permit # 37-033-20220) from 10/13/2009 to 10/22/2009. This well was tested as a disposal well coordinated with and witnessed by Dave Rectenwald of the EPA. The reservoir at the proposed Zelman #1 well is similar in all parameters: depth, depletion, thickness and permeability as indicated by offset flow rates and production data. The following data was obtained:

Total volume injected	4311 bbls
Fluid Density (Marcellus produced fluids)	8.7 to 9.1 ppg
Average Injection Rate	1040 bbls per day
Average Injection Surface Pressure	1225 psig
Draw Down Time	1 minute
Draw Down Pressure	0 psi

Permeability: Utilizing Darcy Flow Equation = 6.1Darcy (see calculations below)

$$Q=7.082 KH (P_e-P_w)$$

$$\frac{Q}{\ln (R_e/R_w)}$$

Where: Q = flow rate (bbls/day)

K = formation permeability (darcy's)

H = formation thickness (ft)

P_e = static external boundary pressure (psia)

P_w = wellbore pressure during injection (psia)

R_e = external radius (ft)

R_w = wellbore radius (ft)

Well Data: Depth to Injection zone	= 7200 G.L.
Average Test injection rate (Q)	= 1040 bbls/day
Reservoir Surface pressure	= 15 psig
Average Wellbore Injection Pressure	= 1225 psig
Wellbore Radius (R _w)	= 0.1979 ft
Average Specific Gravity of test fluid	= 1.07
External Radius (R _e)	= 50.5 ft
Specific Gravity of reservoir gas	= .60
Injection Volume	= 4311 bbls
Gross Thickness	= 78 ft
Net Formation Thickness (H)	= 30 ft
Porosity	= 0.10

Due to the extremely high natural flows encountered in the Chert/Oriskany formations in our project area, standard completion procedures were to top set the Production casing in the Onondago Limestone and then drill –in to the Chert/Oriskany reservoir. When high volumes were encountered the drill piped was tripped and the formation was produced open hole. Therefore most wells were not drilled completely through the Oriskany. Since the field was developed in the late 1950's and early 1960's; log data is not available. Well records closest to the proposed injection well reported the following thickness data:

Permit Number	Distance/Direction	Chert	Oriskany
37-033-20236	1600' Northeast	46	17' in sand
37-033-20047	1850' Southwest	66'	18' in sand

Records research of wells drilled through the Oriskany in Huston Township, Clearfield County provided the following thickness data:

Permit Number	Chert	Oriskany
37-033-20245	63'	31' (located 3450' northeast of the proposed injection well)
37-033-20299	38'	31'
37-033-20183	45'	34'
37-033-20182	47'	29'
37-033-20179	46'	30'

The Chert thickness at the Green Glenn # 1 well is 48' and we will assume an oriskany thickness of 30' for an overall Chert/Oriskany Reservoir of 78'. However for net thickness we will use 30' with a porosity of 10%. This porosity in the Oriskany has been well documented from wells with similar IP data.

Wellbore Pressure Calculation(Pw):

$$P_w = P_{\text{surface}} + P_{\text{Hydrostatic}}$$

$$P_w = 1225 + ((1.07)(.433)(7200))$$

$$P_w = 4560 \text{ psig}$$

$$P_w = 4560 \text{ psig} + 14.7$$

$$P_w = 4575 \text{ psia}$$

External Boundary Pressure Calculation(Pe):

$$P_e = \text{Surface Pressure} + \text{delta P (gas gradient)}$$

$$\text{Delta P} = ((0.25 (P_w/100))(\text{Depth}/100))$$

$$\text{Delta P} = ((.25)(29.7/100)(7200/100))$$

$$\text{Delta P} = 5.3 \text{ psi}$$

$$P_e = 15 \text{ psig} + 14.7 + 5.3$$

$$P_e = 35 \text{ psia}$$

Volumetric Calculation of External Radius(Re):

$$\text{Volume} = .7854 ((D \times D)(H)(\text{Porosity}))$$

$$4311 \text{ bbls (5.615 ft}^3/\text{bbl)} = 0.7854 (D \times D \text{ sq ft})(30 \text{ ft})(.10)$$

$$D \times D = 10,273 \text{ sq ft}$$

$$D = 101 \text{ ft}$$

$$R_e = 50.5 \text{ ft}$$

Permeability Calculation(K):
 $-1040 = 7.082 K (30)(35-4575)$

$\ln(50.5/0.1979)$
 $K = .0061 \text{ md}$

$K = 6.1 \text{ Darcys}$

Fracture Gradient of injection Zone = .9518psi/ft

There is no record of any fracture treatment of this well. However, well records in this area provide the following fracture data:

Permit Number	Operator	Distance/Direction	Breakdown Press	Depth	Fluid
37-033-20238	NYSNG	4800' NE	4075 psi	7363	Water
37-033-20260	Fairman	4950' SW	4500 psi	7257	Water
37-033-20262	NYSNG	5850' NNE	3800 psi	7324	Water

The lowest fracture gradient calculated for the offset wells listed was 0.9518 psi/ft for Well 37-033-20262 as shown below:

P_{btm} = bottom hole pressure

P_{surface} = surface pressure

Phydrostatic = hydrostatic pressure of the wellbore

$P_{btm} = P_{surface} + P_{hydrostatic}$

$P_{btm} = 3800 + (1)(.433)(7324)$

$P_{btm} = 3800 + 3171$

$P_{btm} = 6971$

Fracture Gradient = Bottom hole breakdown pressure/depth

Fracture Gradient = 6971psi/7324ft

Fracture Gradient = 0.9518 psi/ft

Maximum Allowable Injection Rate Calculation = of 2296 bbls/day

$MAIR = \frac{(R)(MAIP)}{MIP}$

MIP

Where: MAIR = maximum allowable injection rate (bbls/day)

R = maximum rate during the injection test (bbls/day)

MAIP = maximum allowable injection pressure (psi)

MIP = maximum pressure during injection test (psi)

$MAIR = \frac{(1350)(2552)}{1500}$

1500

MAIR = 2296 bbls/day

Dannic Energy Injection Test									
Green Glenn #1 DEP ID #37-033-20228									
Date	Time	Rate bbls/day	Vol. bbls	Press. psi	Density ppg	Remarks	Pi psi	Pf psi	time minutes
10/13/2009	8:00:00 AM		0	0	9.10	Gravity fed well to load hole for pump test			
	6:00:00 PM		180	0	9.10				
10/14/2009	6:45:00 AM	850	180	0	9.10	Start Injection Test			
	7:45:00 AM	840	215	0	9.10	increase rate			
	8:45:00 AM	1200	260	0	9.10				
	9:15:00 AM	1175	284	300	9.10	Caught Pressure at 104 bbls on pump			
	9:20:00 AM	0	286	1500	9.10	Shut down; monitor pressure decline	1500	300	40
	10:00:00 AM	620	286	300	9.10	Start Pump			
	10:30:00 AM	0	292	1500	9.10	Shut down; monitor pressure decline	1500	0	25
	11:00:00 AM	425	292	0	9.10	Start Pump			
	11:30:00 AM	0	300	1500	9.10	Shut down; monitor pressure decline	1500	0	20
	12:00:00 PM	425	300	0	9.10	Start Pump			
	12:30:00 PM	0	309	1500	9.10	Shut down; monitor pressure decline	1500	0	10
	1:30:00 PM	425	309	0	9.10	Start Pump			
	1:30:00 PM	0	318	1400	9.10	Shut down; monitor pressure decline	1400	0	7
	2:00:00 PM	425	318	0	9.10	Start pump			
	2:30:00 PM	0	326	1380	9.10	Shut down; monitor pressure decline	1380	0	5
	3:00:00 PM	425	326	0	9.10	Start Pump			
	3:30:00 PM	425	335	1300	9.10	Well taking fluid at 1300 psi			
	4:00:00 PM	850	344	1300	9.10	increase rate			
	5:00:00 PM	850	379	1320	9.10				
	5:15:00 PM	0	390	1320	9.10	shut down for night	1320	0	3
10/15/2009	6:00:00 AM		390	0	9.10	Open well; well on vacuum			
	6:00:00 AM	950	390	0	9.10	Start pump			
	7:00:00 AM	1030	430	0	9.10				
	8:00:00 AM	990	471	0	9.10				
	9:00:00 AM	800	504	0	8.90	Change suction tank			
	10:00:00 AM	800	537	0	8.90				
	11:00:00 AM	800	570	300	8.90				

	12:00:00 PM	900	610	1400	8.90				
	1:00:00 PM	900	645	1380	8.90				
	2:00:00 PM	1000	686	1380	8.90				
	3:00:00 PM	900	722	1380	8.90				
	4:00:00 PM	1000	767	1380	8.90		1380	0	3
10/16/2009	8:00:00 AM	340	992	0	8.90				
	8:00:00 AM	335	992	0	8.80				
	8:05:00 AM	900	995	1400	8.80				
	9:00:00 AM	620	1020	1300	8.80				
	9:30:00 AM	0	1042	1300	8.80		1300	0	3
10/17/2009	9:30:00 AM	350	1392	0	8.80				
10/18/2009	9:30:00 AM	250	1642	0	8.80				
10/19/2009	7:00:00 AM	300	1927	0	8.60				
	1:00:00 PM	900	1927	0	8.60				
	2:00:00 PM	940	1964	1500	8.60				
	3:00:00 PM	900	2003	1500	8.60				
	4:00:00 PM	920	2040	1480	8.60				
	5:00:00 PM	1000	2080	1320	8.60				
	6:00:00 PM	950	2120	1240	8.60				
10/20/009	6:45:00 AM	480	2370	0	8.70				
	7:00:00 AM	1000	2390	1175	8.70				
	8:00:00 AM	1000	2432	1200	8.70				
	9:00:00 AM	975	2471	1200	8.70				
	10:00:00 AM	900	2508	1250	8.70				
	11:00:00 AM	900	2545	1275	8.70				
	12:00:00 PM	1000	2587	1275	9.10				
	1:00:00 PM	980	2628	1220	9.10				
	2:00:00 PM	1200	2678	1220	9.10				
	3:00:00 PM	1025	2721	1210	9.10				
	4:00:00 PM	1025	2763	1170	9.10				
	5:00:00 PM	1030	2806	1140	9.10				
	6:00:00 PM	1030	2850	1100	9.10				
	7:00:00 PM	1025	2889	1100	9.10		1100	0	1

10/21/2009	7:00:00 AM	500	3189	0	8.70	Change suction tank; start pump		
	8:00:00 AM	1000	3231	1150	8.70			
	9:00:00 AM	1050	3275	1200	8.70			
	10:00:00 AM	1050	3318	1220	8.70	Increase pump rate		
	11:00:00 AM	1200	3368	1220	8.70			
	12:00:00 PM	1200	3419	1220	8.70			
	1:00:00 PM	1350	3474	1250	8.70	Increase pump rate		
	2:00:00 PM	1350	3530	1250	8.70			
	3:00:00 PM	1350	3585	1250	8.70			
	4:00:00 PM	1350	3642	1240	8.70			
	5:00:00 PM	1350	3698	1240	8.70			
	6:00:00 PM	1350	3755	1240	8.70			
	7:00:00 PM	1350	3811	1240	8.70		1240	0
10/22/2009	7:00:00 AM	500	4311	0	8.80	Change suction tank; gravity fed well		
						Test Complete		
						Witness Test: Michael G. Hoover		
						Witness Test: Douglas A. Hoover		

RESOURCE MANAGEMENT SERVICES, INC.

65 Fenton Road
Indiana, Pennsylvania
15701

Tel: (724) 465-6556
Fax: (724) 465-8292


December 4, 2009

Waste Characterization
Dannic Energy – Green Glen #1 Disposal Well

Collector: Dannic/MH
Analyses By: Geo-Chemical Testing

Sample Identification: RMS 1/11/13 RMS 2/11/13 RMS 3/11/13 RMS 4/11/13
Lab Identification: G0911360-1 G0911360-2 G0911360-3 G0911360-4

Analyte	RMS 1/11/13	RMS 2/11/13	RMS 3/11/13	RMS 4/11/13	Std Units
pH	4.91	6.30	7.50	5.31	Mg/l as CaCO ₃
Alkalinity	<5	10	40	<5	umhos/cm
Specific Conductance	186,000	705	91	199,000	Mg/l
T. Dissolved Solids	199,000	2750	72	341,000	Mg/l
Chlorides	120,000	210	11	190,000	Mg/l
Lab Dissolved Oxygen	10	7.9	10	NA	Mg/l
T. Organic Carbon	18.6	210	12.7	2.2	gm/ml
Specific Gravity	1.150	1.001	1.001	NA	Mg/l
Sulfate	<5	10	<5	22	Mg/l
Sulfide	<0.1	<0.1	<0.1	<0.1	Mg/l
Aluminum	<1.0	3.1	32.6	<1.0	Mg/l
Barium	426	1.47	0.77	1,960	Mg/l
Calcium	20,500	38.2	14.3	36,900	Mg/l
Iron	70.4	15.6	88.7	300	Mg/l
Magnesium	2,410	3.6	14.7	2,200	Mg/l
Manganese	21.7	0.43	2.31	3.85	Mg/l
Sodium	23,800	94.2	6.5	22,300	Mg/l
Strontium	885	3.22	0.1700	25,300	Mg/l
Hardness	61,000	110	96.5	101,000	Mg/l as CaCO ₃

Submitted By: Resource Management Services

Rick F. Bonazza
President

RMS 1/11/13 shallow brine
RMS 2/11/13 Marcellus
RMS 3/11/13 Drill Pit water
RMS 4/11/13 Oriskany

Clarion County, PA

Constituent	Units	Drill Pit Fluid 5/21/2010	Produced Water 11/17/2010
Acidity	mg/L	22.2	265
Aluminum	ug/L	442 B	399 B J
Ammonia Nitrogen	mg/L	199 J	241
Arsenic	ug/L	94.4 B J	100 U
Barium	ug/L	10500	16200
Benzene	ug/L	460	390
Beryllium	ug/L	40 U	40 U
Biochemical Oxygen Demand	mg/L	783	>2010
Boron	ug/L	15100	9330
Bromide	mg/L	713	999
Cadmium	ug/L	50 U	2.3 B
Calcium	ug/L	11500000 J	16800000
Chemical Oxygen Demand (COD)	mg/L	3810 J	8810
Chloride	mg/L	89100	135000
Chromium	ug/L	12.8 B	22.5 B
Cobalt	ug/L	1250 U	500 U
Copper	ug/L	250 U	250 U
Hardness, as CaCO3	mg/L	45000	86000
Iron	ug/L	30800	56600
Iron Dissolved	ug/L	30800	47200
Lead	ug/L	75 U	30 U
Lithium	ug/L	75600	148000
Magnesium	ug/L	1120000	1490000
Manganese	ug/L	3340	5280
Mercury	ug/L	0.2 U	0.2 U
Molybdenum	ug/L	400 U	400 U
Nickel	ug/L	1000 U	400 U
Nitrate-Nitrite	ug/L	NA	NA
Nitrate	mg/L	5 U G	25 U G
Nitrite	mg/L	5 U G	25 U G
Oil & Grease (HEM)	mg/L	63.9	2080
pH	No Units	6.2	6.0
Selenium	ug/L	50 U	50 U
Silver	ug/L	50 U	50 U
Sodium	ug/L	27900000	33400000
Specific Conductance	umhos/cm	245000 J	520000
Strontium	ug/L	1170000 / 1770000	310000 / 2600000
Sulfate	mg/L	240	153 B J
Toluene	ug/L	800	1900
Total Alkalinity	mg/L	73.8 J	4.7 B J
Total Dissolved Solids	mg/L	119000	260000
Total Kjeldahl Nitrogen	mg/L	NA	149
Total Recoverable Phenolics	mg/L	0.045 J	0.11 J
Total Suspended Solids	mg/L	91.0	102.0
Zinc	ug/L	75.4 B	90 B
MBAS	mg/L	0.199	0.025 U
Ethylene Glycol	mg/L	100 U	1000 U
Uranium	ug/L	5000 U	25000 U
Thorium	ug/L	10000 U	22100
Strontium-90	pCi/L	-29 U	NA
Gross Alpha	pCi/L	35000	10400
Gross Beta	pCi/L	10900	1910
Cesium 137	pCi/L	-6 U	NA

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G - Reporting limit elevated due to matrix interference

Clearfield County, PA

Constituent	Units	Drill Pit Fluid 11/17/2010	Flow Back 11/17/2010
Acidity	mg/L	5 U	5 U
Aluminum	ug/L	1020 B	297 B J
Ammonia Nitrogen	mg/L	29.7	8
Arsenic	ug/L	33.5 B	100 U
Barium	ug/L	5180	9920
Benzene	ug/L	5 U	5 U
Beryllium	ug/L	40 U	40 U
Biochemical Oxygen Demand	mg/L	369	53.2
Boron	ug/L	362 B	1510 B J
Bromide	mg/L	5.1	28
Cadmium	ug/L	50 U	50 U
Calcium	ug/L	186000	373000
Chemical Oxygen Demand (COD)	mg/L	1420	286
Chloride	mg/L	13200	3490
Chromium	ug/L	1270	50 U
Cobalt	ug/L	500 U	500 U
Copper	ug/L	250 U	250 U
Hardness, as CaCO3	mg/L	580	1320
Iron	ug/L	1000	6800
Iron Dissolved	ug/L	491 B	3280
Lead	ug/L	14.5 B	30 U
Lithium	ug/L	242 B	3200
Magnesium	ug/L	15100 B	44300 B
Manganese	ug/L	4760	646
Mercury	ug/L	0.042 B	0.2 U
Molybdenum	ug/L	400 U	400 U
Nickel	ug/L	23.9 B	400 U
Nitrate-Nitrite	ug/L	NA	NA
Nitrate	mg/L	1.2 U	0.5 U G
Nitrite	mg/L	1.2 U G	0.5 U G
Oil & Grease (HEM)	mg/L	19.5	13.1
pH	No Units	7.1	7.4
Selenium	ug/L	50 U	50 U
Silver	ug/L	50 U	50 U
Sodium	ug/L	8030000	1570000
Specific Conductance	umhos/cm	45300	12300
Strontium	ug/L	5200 / 4130 J	117000 / 94700
Sulfate	mg/L	115	126 J
Toluene	ug/L	5 U	5 U
Total Alkalinity	mg/L	568	103 J
Total Dissolved Solids	mg/L	21700	6740
Total Kjeldahl Nitrogen	mg/L	34.3	8.52
Total Recoverable Phenolics	mg/L	0.024	0.016 J
Total Suspended Solids	mg/L	13.2	25.6
Zinc	ug/L	75.6 B	66.2 B
MBAS	mg/L	0.025 U	0.134
Ethylene Glycol	mg/L	1000 U	1000 U
Uranium	ug/L	10000 U	500 U
Thorium	ug/L	5000 U	510
Strontium-90	pCi/L	NA	NA
Gross Alpha	pCi/L	80 U	49
Gross Beta	pCi/L	170	21
Cesium 137	pCi/L	NA	NA

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Greene County, PA

Constituent	Units	Flow Back			Produced Water 4/9/2009
		3/24/2009	3/28/2009	4/1/2009	
Acidity	mg/L	5 U	5 U	5 U	5 U
Aluminum	ug/L	985 B	2,000 U	417 B	522 B
Ammonia Nitrogen	mg/L	90.7 J	110 J	91.4 J	116 J
Arsenic	ug/L	100 U	100 U	26.2 B	100 U
Barium	ug/L	603 B	150 B	13,000	306,000
Benzene	ug/L	75 U	5.1	3.1 J	31
Beryllium	ug/L	40 U	40 U	40 U	40 U
Biochemical Oxygen Demand	mg/L	26.6	36.8	122	218
Boron	ug/L	6,230 J	12,800 J	16,800 J	16,900 J
Bromide	mg/L	0.2 U	0.2 U	262	522
Cadmium	ug/L	50 U	50 U	50 U	50 U
Calcium	ug/L	33,100 B	32,500 B	1,860,000	4,490,000
Chemical Oxygen Demand (COD)	mg/L	705 J	506 J	1,380	3,040
Chloride	mg/L	338	39.6	24,900	46,500
Chromium	ug/L	12.7 B	50 U	28 B	49.9 B
Cobalt	ug/L	5.6 B	5.6 B	500 U	500 U
Copper	ug/L	90.1 B	250 U	250 U	250 U
Hardness, as CaCO3	mg/L	140	140	6,700	20,000
Iron	ug/L	4,600	30,200	17,500	34,000
Iron Dissolved	ug/L	NA	NA	NA	NA
Lead	ug/L	30 U	30 U	30 U	20 B
Lithium	ug/L	43.6 B	36.3 B	19,200	34,900
Magnesium	ug/L	7,820 B	8,530 B	201,000	472,000
Manganese	ug/L	191	598	1,160	2,410
Mercury	ug/L	0.82 B J	0.2 U	0.2 U	0.2 U
Molybdenum	ug/L	400 U	13 B	400 U	400 U
Nickel	ug/L	12.6 B	13.7 B	400 U	13.5 B
Nitrate-Nitrite	ug/L	0.57	0.77 J	0.87 J	0.77 J
Nitrate	mg/L	NA	NA	NA	NA
Nitrite	mg/L	NA	NA	NA	NA
Oil & Grease (HEM)	mg/L	8.6	8.2	6.8	6.4
pH	No Units	50 U	50 U	50 U	29 B
Selenium	ug/L	NA	NA	NA	NA
Silver	ug/L	NA	NA	NA	NA
Sodium	ug/L	NA	NA	NA	NA
Specific Conductance	umhos/cm	1,630	532	223,000	635,000
Strontium	ug/L	NA	NA	NA	NA
Sulfate	mg/L	10	25	2.3 J	23
Toluene	ug/L	194 J	112 J	356 J	206 J
Total Alkalinity	mg/L	1,230	1,010	40,400	83,100
Total Dissolved Solids	mg/L	108	181	148	131
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA
Total Recoverable Phenolics	mg/L	400	0.01 U	90	30.8
Total Suspended Solids	mg/L	83 J	25	15 U	14 J
Zinc	ug/L	NA	NA	NA	NA
MBAS	mg/L	10 U	10 U	100 U	100 U
Ethylene Glycol	mg/L	NA	NA	NA	NA
Uranium	ug/L	NA	NA	NA	NA
Thorium	ug/L	NA	NA	NA	NA
Strontium-90	pCi/L	NA	NA	NA	NA
Gross Alpha	pCi/L	NA	NA	NA	NA
Gross Beta	pCi/L	NA	NA	NA	NA
Cesium 137	pCi/L	NA	NA	NA	NA

Greene County, PA

Constituent	Units	Flow Back				Produced Water 4/17/2009
		4/1/2009	4/3/2009	4/7/2009	4/17/2009	
Acidity	mg/L	5 U	5 U	5 U	40.8	345
Aluminum	ug/L	166 B	176 B	571 B	539 B J	1020 B J
Ammonia Nitrogen	mg/L	15.6 J	36.3 J	70.3 J	NA	214 J
Arsenic	ug/L	100 U	100 U	35.4 B	50.8 B	100 U
Barium	ug/L	2210	26700	434000	1010000 J	2110000
Benzene	ug/L	5 U	7.8	5.8	17	5 U
Beryllium	ug/L	40 U	40 U	40 U	40 U	40 U
Biochemical Oxygen Demand	mg/L	788	158	106	32.4	26
Boron	ug/L	414 B J	8360 J	14400 J	16800	18600
Bromide	mg/L	32.8	172	536	880	1430
Cadmium	ug/L	50 U	50 U	50 U	4.4 B J	50 U
Calcium	ug/L	227000	1030000	4950000	9600000 J	19400000
Chemical Oxygen Demand (COD)	mg/L	996	1330	17700	4670	8570
Chloride	mg/L	3560	16900	48900	76800	121000 J
Chromium	ug/L	50 U	50 U	50 U	14 B J	50 U
Cobalt	ug/L	500 U	500 U	1000 U	1000 U	5000 U
Copper	ug/L	250 U	250 U	250 U	250 U	250 U
Hardness, as CaCO3	mg/L	1060	4700	20000	39200	106000
Iron	ug/L	1180	12400	28200	74800	144000
Iron Dissolved	ug/L	NA	NA	NA	NA	NA
Lead	ug/L	30 U	30 U	60 U	38.2 B J	30 U
Lithium	ug/L	808	11800	34600	56100	112000
Magnesium	ug/L	49400 B	131000	559000	1000000	1810000
Manganese	ug/L	189	782	2630	5170 J	10400
Mercury	ug/L	0.2 U	0.2 U	0.2 U	0.2 U	0.2 U
Molybdenum	ug/L	400 U	19.7 B	8.7 B	400 U	400 U
Nickel	ug/L	400 U	10.6 B	800 U	800 U	400 U
Nitrate-Nitrite	ug/L	1.1 J	0.38 J	0.38 J	0.91 J	0.085 B
Nitrate	mg/L	NA	NA	NA	NA	NA
Nitrite	mg/L	NA	NA	NA	NA	NA
Oil & Grease (HEM)	mg/L	6.6 U	5 U	5.1	4.9 U	6.1
pH	No Units	7	6.9	6.5	6	5.9
Selenium	ug/L	50 U	50 U	50 U	30.1 B	50 U
Silver	ug/L	50 U	50 U	50 U	50 U	50 U
Sodium	ug/L	1460000	7540000	21300000	32600000	47700000
Specific Conductance	umhos/cm	4980 J	68400 J	183000 J	256000 J	468000
Strontium	ug/L	23200	139000	650000	1370000 J	2870000 J
Sulfate	mg/L	50.3	10.7 B J	40.2 B J	39.8 B J	42.4 B J
Toluene	ug/L	5.6	3.8 J	7.7	13	5 U
Total Alkalinity	mg/L	308 J	278 J	135 J	87.9 J	40.3 J
Total Dissolved Solids	mg/L	5910	28900	55100	124000	199000
Total Kjeldahl Nitrogen	mg/L	7.8	42.5	86.1	95.5	146
Total Recoverable Phenolics	mg/L	0.14 J	0.057 J	0.0076 B	0.011	0.0089 B
Total Suspended Solids	mg/L	1040	7	47	1100	237
Zinc	ug/L	200 U	406	264	200 U	147 B J
MBAS	mg/L	0.05 U	0.0621	0.258	0.05 U	0.05 U
Ethylene Glycol	mg/L	1000 UJ	100 UJ	100 UJ	50 UJ	50 UJ
Uranium	ug/L	NA	NA	NA	NA	NA
Thorium	ug/L	NA	NA	NA	NA	NA
Strontium-90	pCi/L	NA	NA	NA	NA	NA
Gross Alpha	pCi/L	NA	NA	NA	NA	NA
Gross Beta	pCi/L	NA	NA	NA	NA	NA
Cesium 137	pCi/L	NA	NA	NA	NA	NA

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Greene County, PA

Constituent	Units	Flow Back			Produced Water 5/13/2009
		2/12/2009	2/13/2009	2/17/2009	
Acidity	mg/L	5 U	5 U	5 U	162
Aluminum	ug/L	298 J	887 J	47200 J	358 B
Ammonia Nitrogen	mg/L	1.8 J	5.4 J	34.1 J	96
Arsenic	ug/L	10 U	17.5	92.9	54 B
Barium	ug/L	111 B	7620	165000	1440000
Benzene	ug/L	2000 U	250 U	100 U	5 U
Beryllium	ug/L	4 U	4 U	20 U	40 U
Biochemical Oxygen Demand	mg/L	438	656	721	1080
Boron	ug/L	109 B E	5420	12200	13000 J
Bromide	mg/L	1	35.5	242	766
Cadmium	ug/L	5 U	5 U	7.4 B	2.5 B
Calcium	ug/L	52700	297000	2260000 J	8500000 J
Chemical Oxygen Demand (COD)	mg/L	3450	1290	6970	8590
Chloride	mg/L	234	4900 J	26800 J	78300
Chromium	ug/L	4.3 B	32.6	130	50 U
Cobalt	ug/L	1.1 B	50 U	250 U	1000 U
Copper	ug/L	28.6	22.5 B	2280	250 U
Hardness, as CaCO3	mg/L	230	1500	8400	40000
Iron	ug/L	1720	14700	140000 J	87800
Iron Dissolved	ug/L	NA	NA	NA	NA
Lead	ug/L	4.7	3	349	45.6 B
Lithium	ug/L	17.5 B	4350	21400	44500
Magnesium	ug/L	16700	40800	291000	933000
Manganese	ug/L	146	1150	3290	4720
Mercury	ug/L	0.025 B	0.05 B J	0.24 J	0.2 U
Molybdenum	ug/L	40 U	10.5 B	50.5 B J	400 U
Nickel	ug/L	6.2 B	17.6 B	187 B	800 U
Nitrate-Nitrite	ug/L	0.73 J	0.61 J	0.52 J	0.1 U
Nitrate	mg/L	NA	NA	NA	NA
Nitrite	mg/L	NA	NA	NA	NA
Oil & Grease (HEM)	mg/L	NA	4.8 U	350	21.3
pH	No Units	7.1	7.7	6.6	6.2
Selenium	ug/L	5 U	4.3 B	25 U	50 U
Silver	ug/L	5 U	5 U	25 U	50 U
Sodium	ug/L	321000	2860000	12900000	26900000
Specific Conductance	umhos/cm	1970 J	19200 J	122000 J	249000 J
Strontium	ug/L	789 J E	24100 J	345000	1220000
Sulfate	mg/L	374 J	348 J	25.9 J	50 G U
Toluene	ug/L	2000 U	250 U	100 U	5 U
Total Alkalinity	mg/L	120 J	577 J	266 J	75.2 J
Total Dissolved Solids	mg/L	1410	9020	40700	155000
Total Kjeldahl Nitrogen	mg/L	25.8	21.8	46.5	92.8
Total Recoverable Phenolics	mg/L	0.065 J	0.01 U	0.028	0.0091 B
Total Suspended Solids	mg/L	16	23.2	3220	153
Zinc	ug/L	43.6	248	2930 J	29.3 B J
MBAS	mg/L	NA	3.38	0.210	4.54
Ethylene Glycol	mg/L	50 U	50 U	52	100 UJ
Uranium	ug/L	NA	NA	NA	NA
Thorium	ug/L	NA	NA	NA	NA
Strontium-90	pCi/L	NA	NA	NA	NA
Gross Alpha	pCi/L	NA	NA	NA	NA
Gross Beta	pCi/L	NA	NA	NA	NA
Cesium 137	pCi/L	NA	NA	NA	NA

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Indiana County, PA

Constituent	Units	Produced Water 11/17/2010	
Acidity	mg/L	24.0	
Aluminum	ug/L	226	B J
Ammonia Nitrogen	mg/L	85.1	
Arsenic	ug/L	100	U
Barium	ug/L	2610000	
Benzene	ug/L	5	U
Beryllium	ug/L	40	U
Biochemical Oxygen Demand	mg/L	668	
Boron	ug/L	16300	
Bromide	mg/L	624	
Cadmium	ug/L	50	U
Calcium	ug/L	10300000	
Chemical Oxygen Demand (COD)	mg/L	7770	
Chloride	mg/L	68900	
Chromium	ug/L	155	
Cobalt	ug/L	2500	U
Copper	ug/L	250	U
Hardness, as CaCO3	mg/L	36000	
Iron	ug/L	131000	
Iron Dissolved	ug/L	101000	
Lead	ug/L	30	U
Lithium	ug/L	89900	
Magnesium	ug/L	914000	
Manganese	ug/L	3780	
Mercury	ug/L	0.2	U
Molybdenum	ug/L	400	U
Nickel	ug/L	400	U
Nitrate-Nitrite	ug/L	NA	
Nitrate	mg/L	5	U G
Nitrite	mg/L	5	U G
Oil & Grease (HEM)	mg/L	95.3	
pH	No Units	6.6	
Selenium	ug/L	50	U
Silver	ug/L	50	U
Sodium	ug/L	28000000	
Specific Conductance	umhos/cm	245000	
Strontium	ug/L	1900000 / 2440000	
Sulfate	mg/L	35.7	B J
Toluene	ug/L	5	U
Total Alkalinity	mg/L	141	J
Total Dissolved Solids	mg/L	94400	
Total Kjeldahl Nitrogen	mg/L	23.1	
Total Recoverable Phenolics	mg/L	0.065	J
Total Suspended Solids	mg/L	97	
Zinc	ug/L	110	B
MBAS	mg/L	0.0581	
Ethylene Glycol	mg/L	1000	U
Uranium	ug/L	25000	U
Thorium	ug/L	12700	
Strontium-90	pCi/L	NA	
Gross Alpha	pCi/L	16600	
Gross Beta	pCi/L	4790	
Cesium 137	pCi/L	NA	

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Washington County, PA

Constituent	Units	Supply Water	Flow Back				Produced Water 6/29/2009
		3/24/2009	3/24/2009	3/27/2009	4/1/2009	4/9/2009	
Acidity	mg/L	5U	5U	5U	5U	122	388
Aluminum	ug/L	2000 U	2000 U	510 B	950 B	1450 B	2570
Ammonia Nitrogen	mg/L	20.8 J	12.9 J	60.3 J	115 J	135 J	168 J
Arsenic	ug/L	100 U	100 U	36.9 B	78.4 B	82.8 B	109
Barium	ug/L	74.7 B	91.4 B	19200	77100	83100	87200
Benzene	ug/L	5 U	5 U	280	880	400	290
Beryllium	ug/L	40 U	40 U	40 U	40 U	40 U	40 U
Biochemical Oxygen Demand	mg/L	2.7	154	75.4	64.8	120	12400
Boron	ug/L	65.9 B J	122 B J	12600 J	12200 J	14700 J	12700
Bromide	mg/L	0.2 U	0.2 U	376	826	1040	1600
Cadmium	ug/L	50 U	50 U	50 U	2.2 B	4.7 B	3.2 B
Calcium	ug/L	49800 B	59500	3980000	8880000	14000000	2E+07 J
Chemical Oxygen Demand (COD)	mg/L	13.2 J	851 J	2470 J	5170	8370	18400
Chloride	mg/L	18.5	30.7	31500	72000	100000	138000 J
Chromium	ug/L	50 U	50 U	11.4 B	39.3 B	32.8 B	15.8 B
Cobalt	ug/L	500 U	500 U	10.5 B	1000 U	2500 U	5000 U
Copper	ug/L	250 U	49.3 B	62.1 B	116 B	73.3 B	250 U
Hardness, as CaCO3	mg/L	182	190	12300	34000	53000	77000
Iron	ug/L	882 B	2440	12200	49600	75200	68700 J
Iron Dissolved	ug/L	NA	NA	NA	NA	NA	NA
Lead	ug/L	30 U	30 U	25.2 B	61	106 B	300 U
Lithium	ug/L	500 U	30.1 B	33900	55900	86000	105000
Magnesium	ug/L	6700 B	7910 B	394000	881000	1380000	2E+06
Manganese	ug/L	116 B	140 B	2390	4680	7320	8990 J
Mercury	ug/L	0.61 B J	0.66 B J	0.065 B J	0.2 U	0.2 U	0.2 U
Molybdenum	ug/L	400 U	400 U	11.5 B	30.8 B	400 U	400 U
Nickel	ug/L	400 U	25.1 B	15.3 B	26.4 B	2000 U	4000 U
Nitrate-Nitrite	ug/L	0.51	0.47	0.45 J	0.34 J	0.25 J	0.1 U
Nitrate	mg/L	NA	NA	NA	NA	NA	NA
Nitrite	mg/L	NA	NA	NA	NA	NA	NA
Oil & Grease (HEM)	mg/L	4.7 U	7.3	4.9 U	20.4	9.9	802
pH	No Units	6.7	7	6.4	6.4	6.2	5.9
Selenium	ug/L	50 U	50 U	50 U	50 U	50 U	49.9 B
Silver	ug/L	50 U	50 U	50 U	50 U	50 U	50 U
Sodium	ug/L	7980 B	25700 B	14700000	23700000	34000000	4E+07
Specific Conductance	umhos/cm	575 J	476 J	124000 J	233000 J	288000 J	480000 J
Strontium	ug/L	220 B	303 B	539000	1350000	2100000	3E+06 J
Sulfate	mg/L	139	59.2	102	60.7 B	89.3 J	32.8 B J
Toluene	ug/L	1.1 J	5 U	300	920	540	1600
Total Alkalinity	mg/L	80.9 J	126 J	157 J	54 J	60.2 J	11.5 J
Total Dissolved Solids	mg/L	215	462	61200	116000	157000	200000
Total Kjeldahl Nitrogen	mg/L	56.4	33.5	77.7	55.9	127	87.7
Total Recoverable Phenolics	mg/L	0.01 U	0.085	0.058	0.016 J	0.01 U	0.23
Total Suspended Solids	mg/L	16.8	90 B	6.8	204	209	83
Zinc	ug/L	200 U	59.5 B J	132 B J	106 B	123 B	218
MBAS	mg/L	0.0613	0.112	0.0641	0.05 U	0.465	0.699
Ethylene Glycol	mg/L	10 U	44	10 U	100 UJ	100 UJ	290 J
Uranium	ug/L	NA	NA	NA	NA	NA	NA
Thorium	ug/L	NA	NA	NA	NA	NA	NA
Strontium-90	pCi/L	NA	NA	NA	NA	NA	NA
Gross Alpha	pCi/L	NA	NA	NA	NA	NA	NA
Gross Beta	pCi/L	NA	NA	NA	NA	NA	NA
Cesium 137	pCi/L	NA	NA	NA	NA	NA	NA

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Washington County, PA

Constituent	Units	Flow Back				Produced Water 4/29/2009
		1/26/2009	1/29/2009	2/2/2009	2/10/2009	
Acidity	mg/L	5 U	5 U	107	106	185
Aluminum	ug/L	481	328	166 B	1000 U	811 B J
Ammonia Nitrogen	mg/L	9.3 J	32 J	82.4 J	107 J	259
Arsenic	ug/L	9.1 B	13.5	50 U	12.6 B	114
Barium	ug/L	9810	3570	21400 J	74200 J	133000
Benzene	ug/L	150 U	240	1200	420	360
Beryllium	ug/L	4 U	4 U	20 U	2.2 B	40 U
Biochemical Oxygen Demand	mg/L	2 U	132	1950	149	33.6
Boron	ug/L	2140 J	9260 J	14300 J	16200 J	13500 J
Bromide	mg/L	107	120	544	849	1380 J
Cadmium	ug/L	10.5	5 U	25 U	1.4 B	7.7 B
Calcium	ug/L	2990000	1370000 J	7630000 J	12500000 J	1.8E+07 J
Chemical Oxygen Demand (COD)	mg/L	1730	1340	6120	4340	36600
Chloride	mg/L	10700 J	10500 J	50000	78600 J	122000
Chromium	ug/L	4.8 B	11.1	7.5 B	8.4 B	20.9 B
Cobalt	ug/L	50 U	50 U	250 U	250 U	2500 U
Copper	ug/L	21 B	25 U	125 U	125 U	27.2 B
Hardness, as CaCO3	mg/L	9500	4700	26400	43500	85000
Iron	ug/L	11600	6030	20400 J	54200	69700
Iron Dissolved	ug/L	NA	NA	NA	NA	NA
Lead	ug/L	111	3.8	15 U	15 U	68 B
Lithium	ug/L	14900 J E	13900 E	49100 J E	73700 J	88600
Magnesium	ug/L	235000	153000	817000	1330000 J	1710000
Manganese	ug/L	3640	1060	4220	7090	8830
Mercury	ug/L	0.55 J	0.05 B	0.023 B	0.049 B J	0.2 U
Molybdenum	ug/L	8.9 B J	28.8 B J	9.6 B J	6.8 B J	400 U
Nickel	ug/L	10.4 B	18.6 B J	11 B	7 B	2000 U
Nitrate-Nitrite	ug/L	0.15	0.27 J	0.15 J	0.089 B J	NA
Nitrate	mg/L	NA	NA	NA	NA	NA
Nitrite	mg/L	NA	NA	NA	NA	NA
Oil & Grease (HEM)	mg/L	19.4	5.7	4.8 U	30.8	14.7
pH	No Units	7.6	7.8	6.6	5.5	6.1
Selenium	ug/L	5 U	5 U	25 U	25 U	44 B
Silver	ug/L	0.82 B	0.73 B	2.8 B	5.5 B	50 U
Sodium	ug/L	6190000	6370000	22000000 J	32500000 J	3.4E+07
Specific Conductance	umhos/cm	34600 J	48800 J	175000 J	284000 J	440000 J
Strontium	ug/L	439000 E	167000 E	1080000 J E	1850000 J	2520000
Sulfate	mg/L	198 J	222 J	106	60.1 J	83.8 J
Toluene	ug/L	81 J	340	2300	820	660
Total Alkalinity	mg/L	121 J	226 J	97.6 J	53.2 J	43.1 J
Total Dissolved Solids	mg/L	27800	22400	87800	112000	194000
Total Kjeldahl Nitrogen	mg/L	23	51	71.7	112	136
Total Recoverable Phenolics	mg/L	0.082	0.064	0.01 U	0.015	0.039 J
Total Suspended Solids	mg/L	790	81	35.6	17	150
Zinc	ug/L	117 J	86.9 J	84.9 B J	66.8 B	73.8 B J
MBAS	mg/L	0.500 U	0.0691	0.131	0.0857	0.138
Ethylene Glycol	mg/L	20.1	20.6	20.8	11	100 UJ
Uranium	ug/L	NA	NA	NA	NA	NA
Thorium	ug/L	NA	NA	NA	NA	NA
Strontium-90	pCi/L	NA	NA	NA	NA	NA
Gross Alpha	pCi/L	NA	NA	NA	NA	NA
Gross Beta	pCi/L	NA	NA	NA	NA	NA
Cesium 137	pCi/L	NA	NA	NA	NA	NA

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Washington County, PA

Constituent	Units	Flow Back			Produced Water 4/22/2009
		4/16/2009	4/16/2009	4/18/2009	
Acidity	mg/L	5 U	5 U	5 U	5 U
Aluminum	ug/L	176 B J	2000 U	526 B J	315 B J
Ammonia Nitrogen	mg/L	0.2 U	2	16	165 J
Arsenic	ug/L	100 U	100 U	100 U	57.1 B
Barium	ug/L	61 B J	114 B J	2,520 J	249,000 J
Benzene	ug/L	5 U	5 U	2.5 J	17
Beryllium	ug/L	40 U	40 U	40 U	40 U
Biochemical Oxygen Demand	mg/L	2 U	442	101	122
Boron	ug/L	42.6 B	87.1 B	6,520	15,700
Bromide	mg/L	0.2 U	1 G U	82.9	386
Cadmium	ug/L	50 U	50 U	50 U	1.4 B J
Calcium	ug/L	23,500 B J	29,700 B J	465,000 J	3,400,000 J
Chemical Oxygen Demand (COD)	mg/L	32.6	1,740	1,080	2,820
Chloride	mg/L	19.6	75.5	7,430	35,600
Chromium	ug/L	50 U	50 U	13.1 B J	30 B J
Cobalt	ug/L	500 U	500 U	5.7 B	500 U
Copper	ug/L	250 U	250 U	250 U	250 U
Hardness, as CaCO3	mg/L	84	110	1,660	11,000
Iron	ug/L	105 B	293 B	7,660	27,200
Iron Dissolved	ug/L	NA	NA	NA	NA
Lead	ug/L	30 U	30 U	30 U	30 U
Lithium	ug/L	500 U	27.5 B	8,730	34,400
Magnesium	ug/L	5,540 B	6,200 B	45,100 B	329,000
Manganese	ug/L	10.4 B J	64 B J	681 J	1,680 J
Mercury	ug/L	0.2 U	0.2 U	0.2 U	0.2 U
Molybdenum	ug/L	400 U	400 U	73.1 B E	46.2 B
Nickel	ug/L	400 U	400 U	400 U	400 U
Nitrate-Nitrite	ug/L	0.4 J	0.46 J	0.51 J	0.43 J
Nitrate	mg/L	NA	NA	NA	NA
Nitrite	mg/L	NA	NA	NA	NA
Oil & Grease (HEM)	mg/L	7.3	7	7.3	6.6
pH	No Units	50 U	50 U	50 U	50 U
Selenium	ug/L	NA	NA	NA	NA
Silver	ug/L	NA	NA	NA	NA
Sodium	ug/L	NA	NA	NA	NA
Specific Conductance	umhos/cm	208 B J	564 J	53,800 J	477,000 J
Strontium	ug/L	NA	NA	NA	NA
Sulfate	mg/L	5 U	5 U	1.6 J	20
Toluene	ug/L	32.6 J	75.8 J	270 J	176 J
Total Alkalinity	mg/L	80	657	12,900	64,700
Total Dissolved Solids	mg/L	2.8 B	50	17.6	107
Total Kjeldahl Nitrogen	mg/L	NA	NA	NA	NA
Total Recoverable Phenolics	mg/L	4.4	220	109	24
Total Suspended Solids	mg/L	15 U	3.3 J	15 U	15
Zinc	ug/L	NA	NA	NA	NA
MBAS	mg/L	50 U	100 U	NA	NA
Ethylene Glycol	mg/L	NA	NA	NA	NA
Uranium	ug/L	NA	NA	NA	NA
Thorium	ug/L	NA	NA	NA	NA
Strontium-90	pCi/L	NA	NA	NA	NA
Gross Alpha	pCi/L	NA	NA	NA	NA
Gross Beta	pCi/L	NA	NA	NA	NA
Cesium 137	pCi/L	NA	NA	NA	NA

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