Attachment B: Geological and Geophysical Information

Porosity and Permeability Information:

The wells penetrating the injection zone in the general area of Brady Township were drilled prior to the typical use of wireline logging techniques.

Therefore, the porosity at our location is presumed to be 10% since that is the value of a typical Oriskany Well log with similar IP's.

Upon completion of drilling Open Hole log suites will be run to determine the porosity at the Zelman#1 location.

Additionally, since the well has not been completed, we do not have specific Permeability data at our location.

However, 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 co-ordinated with and witnessed by Dave Rectenwald of the EPA. The reservoir at the proposed Zelman#1 is similar in the following parameters: depth, depletion, thickness, and permeability as indicated by IP's and production data.

Please find Attached "Green Glenn #1 Injection Test" for calculations and data.

Green Glenn #1 Injection TEST

An Injectivity Test was conducted on the Green Glenn # 1 Well from 10/13/2009 to 10/22/2009.

The following data was obtained: (See "Attachment I: Appendix -1 Injection Test Data")

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 = 6.1 md (see calculations below)

$$Q = \frac{7.082\ KH\ (Pe-Pw)}{\ln (Re/Rw)}$$

Where: Q = flow rate (bbls/day)
K = formation permeability (darcy's)
H = formation thickness (ft)
Pe = static external boundary pressure (psia)
Pw = wellbore pressure during injection (psia)
Re = external radius (ft)
Rw = 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 InjectionPressure	= 1225 psig
	Wellbore Radius (Rw)	= 0.1979 ft
	Average Specific Gravity of test fluid	= 1.07
	External Radius (Re)	= 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'

(See Attachment I – Appendix 2; Well Records)

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. (See Attachment I – Appendix 3; Oriskany Well Log)

Wellbore Pressure Calculation(Pw):
Pw = Psurface +PHydrostatic
Pw = 1225 + ((1.07)(.433)(7200))
Pw = 4560 psig
Pw = 4560 psig + 14.7
Pw = 4575 psia

External Boundary Pressure Calculation(Pe):
Pe = Surface Pressure + delta P (gas gradient)
Delta P =((0.25 (Pw/100)(Depth/100))
Delta P =((.25)(29.7/100)(7200/100))
Delta P = 5.3 psi
Pe = 15 psig + 14.7 + 5.3
Pe = 35 psia

Green Glenn #1 Injection

Volumetric Calculation of External Radius(Re):
Volume= .7854 ((DxD))(H)(Porosity)
4311 bbls (5.615 ft3/bbl) = 0.7854 (DxD sq ft)(30 ft)(.10)
D xD = 10,273 sq ft
D = 101 ft
Re = 50.5 ft

Permeability Calculation(K):

$$-1040 = \frac{7.082\ K\ (30)(35-4575)}{\text{Ln}\ (50.5/0.1979)}$$

K = 0.0061 Darcies

K = .0061 Darcies x 1 md/.001 Darcy = 6.1 md

EPA Permit# PAS2D020BLCE
DEP Permit# 37-033-27255-00-00

	Dannic Energy Injection Test								
	Green Glenn #1 DEP ID #37-033-20228								
Date	Time	Rate	Vol.	Press.	Density	Remarks	Pi	Pf	time
		bbls/day	bbls	psi	ppg		psi	psi	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	Shut down pump for night; gravity fed hole	1380	0	3
10/16/2009	8:00:00 AM	340	992	0	8.90	well on vacuum; gravity 225 bbls			
	8:00:00 AM	335	992	0	8.80	Change suction tank; start pump			
	8:05:00 AM	900	995	1400	8.80				
	9:00:00 AM	620	1020	1300	8.80	Pump problems; shut down high temp			
	9:30:00 AM	0	1042	1300	8.80	Bad Temp sensor in pump motor shut down	1300	0	3
						Scheduled bond log; gravity fed hole			
10/17/2009	9:30:00 AM	350	1392	0	8.80	gravity 350 bbls			
10/18/2009	9:30:00 AM	250	1642	0	8.80	gravity 250 bbls			
10/19/2009	7:00:00 AM	300	1927	0	8.60	gravity 300 bbls; log well			
	1:00:00 PM	900	1927	0	8.60	Start Pump			
	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	Shut pump down for night; gravity fed well			
10/20/009	6:45:00 AM	480	2370	0	8.70	Start Pump			
	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	Change suction tank			
	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	Shut pump down for night; gravity fed well	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	1
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			

EPA Permit# PAS2D020BLCE
DEP Permit# 37-033-27255-00-00

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
841 Chestnut Building
Philadelphia, Pennsylvania 19107

[illegible]

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.

Pmax = [Frac. Grad. - (.433 x Spec. Grav.)] x Depth

= [0.90 - (.433 x 1.2)] x 8469

= 3218 psi

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

Sincerely,

S. Stephen Platt

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

cc: Dave Rectenwald

EPA Permit# PAS2D020BLCE
DEP Permit# 37-033-27255-00-00

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 = Psurface + Phydrostatic

= 3200 + 1.2 (.433) (8469)

= 7600 psi

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

Proposed = Pbd - Ph
Injection Pressure = (.9 - .52)8469 = 3200 psia

Frictional Pressures*

Pump Rate (BPM)	Pressure Loss per 1000' of 2 7/8" Tubing (PSI/1000')	Pressure Loss 8400' of 2 7/8" Tubing (PSI)
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.

EPA Permit# PAS2D020BLCE
DEP Permit# 37-033-27255-00-00

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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

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

DATE: OCT 26 1984

FROM: Charles Kleeman
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 Damson 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	@ 8912	@ 8912
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:

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

cc: Jon Capacasa
Steve Platt

EPA Permit# PAS2D020BLCE
DEP Permit# 37-033-27255-00-00

W. SHANKSVILLE SALTWATER 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/F

EPA Permit# PAS2D020BLCE
DEP Permit# 37-033-27255-00-00

WINDFALL OIL & GAS

Mailing Address
P.O. Box 738
Falls Creek, PA 15840

Shop Location
63 Hill Street
Falls Creek, PA 15840

Office Location
377 Aviation Way
Reynoldsville, PA 15851

T 814.771.9686
F 814.371.0678

Mr. Stephen Platt
EPA Region III
1650 Arch Street
Philadelphia, Pa 19103

Re: Underground Injection Control Permit Number PAS2D020BCLE
Public Hearing Testimonial

Dear Mr. Platt,

I, Michael G. Hoover, president of Windfall Oil & Gas would like to enter the following statements into public record for the consideration of the proposed Zelman #1 injection well. Although some of the statements do not fall under the review of the EPA, I feel it is important to correct some of the misstatements and/or misrepresentations that were made at the public hearing made on December 10, 2012 regarding the proposed Zelman#1 well.

Residential Area

Several of the testimonials stated that highland street is a residential area. The project area is not zoned as residential. A review of courthouse records made in 2011 showed there was no zoning ordinance on file for Brady Township, Clearfield County. This was confirmed by telephone conversation with the Brady Township Secretary on July 23, 2012. Additionally, only one residence of Highland Street can be seen from the proposed wellhead at an approximate distance of 1100 feet. The access road will pass between two residences. One being the lessor and the other, a relative, who signed a right of way agreement and therefore we conclude has no objections to the project. Photos of the project area attached. A portion of the access road is used by two residences that live beyond our project area; however we will be making significant improvement to this existing right of way.

Topographic Map

Testimony at the hearing stated that the permit application had omitted the required topographic map. Attachment D-E of the permit application does include a topographic map extending one mile beyond the wellbore in exhibit "1" subtitled location map.

Wellbore Design/Schematic
Testimony was provided at the hearing that the casing design or wellbore schematic was not provided in the permit application. A wellbore schematic was provided in Attachment "M" of the application. The casing and cementing specifications along with setting depths were also provided in Attachment "L". Please note that a change was made to the 8 5/8 casing depth from 1200' to 1000' due to concerns contained within the notice of deficiency from the EPA. This casing depth change was approved by the EPA and discussed with Pennsylvania DEP for compliance with minimum casing depth regulations.

Coal Mines
Testimony at the hearing stated that the permit application had omitted the coal map showing locations of mines. Attachment D-E of the permit application provided a map of the location of the Lower Freeport mine at Exhibit #3. Further our geologic study indicated that solid coal will be encountered at the proposed Site. We have subsequently reviewed (7) well records within a radius of 1800 feet from the proposed well and no open mines were encountered during drilling operations. The proposed casing and cementing program as designed and presented in the application had taken this coal seam into consideration with the 375' string of 11 ¾ inch casing.

Monitoring Program
Testimony at the hearing indicated that our proposed monitoring program was inaccurate since we were denied continued access to two of the private water sources that were recommended as monitoring points in the hydrology study. The study is included in attachment D-E. The monitoring program proposed in attachment "P" under 'local water sources' stated that we had been denied continued access and provides our proposed monitoring points.

Faults
Testimony at the hearing discussed the location and transmissive nature of faults. Attachment "G" of the permit application provided a map of the faults of public record, as required. However, as discussed in this attachment, the northern fault is not located as mapped and if it does exist it falls outside the AOR. A tabulation of formation tops from well records included in this section is evidence that the Chert/Oriskany is on the same "block" for a minimum distance of 1750 feet north of the proposed well.

Regarding the southern fault, we agree that fault lies between 1200 and 1450 feet southeast of the proposed well. Well records from wells 37-033-20327 and 37-033-20325 report a subsea depth to the Onondaga at -5579 and -5988 respectively.

However we submit the following evidence of the non-transmissive nature of the fault.
Well permit # 37-033-20327 was completed in September 1960 with a natural flow of 7,312,000 cubic feet per day and a post fracture open flow of 30,370,000 cubic feet per day of gas with a pressure of 3293 psi. Well permit #37-033-20325 was completed in October 1960. No gas was reported and the well was plugged and abandoned.

The fact the Northern well had an extremely prolific open flow with a pressure of 3293 psi and the southern well had no flow is evidence the fault is not transmissive.

Also, note the northern productive well was fractured on 9/27/1960 with reported pressures of 3800 psi at an approximate distance of 250' from the fault line. Since no gas was encountered across the fault line in the southern well subsequent to fracture operations is evidence of a competent boundary.

I hope this information is helpful in your continued review of our proposal.

Yours Truly,

Michael G. Hoover