NMOCC Hearing to Amend Order R-12546

DCP Midstream LP Linam AGI #1

Case No. 13589

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Geolex, Inc.

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Summary of Original Order Requirements for MAOP and Injection Rate

- MAOP of 2644 psi with $SG_{TAG} = 0.8$
- Calculated using NMOCD's equations:

  $PG=0.2 + 0.433(1.04-SG_{TAG})$ and

  $IP_{max}=PG*Depth$
- No injection rate limitation

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Revision of Order R-12546 to Include New Pressure and Rate Limitation

- Resulted from need to operate before resolving need to have OCD approved GW discharge plan for AGI facility
- NMOCD has determined Discharge Plan is not needed for this facility
- DCP is therefore requesting a return to the operating conditions specified in the original order (MAOP 2644psi and no rate limitation)

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Summary History of Linam AGI Operation

- Began injecting acid gas in December 2009 under revised order with MAOP of 1800 psi and rate limited to 4 MMCFD of TAG
- Average Injection Temperature 95°F
- Median Injection Temperature 104°F
- Average and Median Injection Pressure 1149 psi
- Injection rate variable depending on inlet gas concentrations of CO_2 (1.5-2.5 mole %)
- H_2S concentrations stable at 0.57 mole %

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Assumptions in Calculating ROE for H_2S Contingency Plan

- Assumed worst case of 225 MMCFD throughput with 0.57 mole % H_2S in inlet gas
- Assumed 1.5% CO_2 in inlet gas
- Results in 4.6 MMCFD of TAG with 72% CO2 and 18% H_2S
- Results in 500ppm ROE of 4057 ft and 100ppm ROE of 8877 ft at plant
- Results in 500ppm ROE of 4073 ft and 100ppm ROE of 8914 ft at AGI site

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ROE Map from H_2S Contingency Plan

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Effect of Rising CO_2 Concentrations in Inlet Gas

- Additional CO_2 in inlet gas (1.5% vs 2.5%) results in higher volumes of TAG to be injected
- Since H_2S concentration has not changed, the ROE for the worst case release based on maximum throughput does not change with more TAG
- TAG density decreases due to relatively higher percentage of CO_2 vs H_2S (72:28 vs 82:18)
- Higher injection rate required to dispose of additional TAG

Pressure and Volume Injection Conditions under Original Assumptions

Table 1 Pressure and Volume Calculations for TAG, Linam under Previous CO2 Inlet Concentrations at Maximum Plant Capacity of 225 MMCFD

PROPOSED INJECTION STREAM CHARACTERISTICS

TAG	H_2S	CO_2	H_2S	CO_2	TAG
Gas vol MMSCFD	conc mol %	conc mol %	inject rate lb/day	inject rate lb/day	inject rate lb/day
4.6	28	72	122260	405973	528233

CONDITIONS AT WELL HEAD

Well Head Conditions		TAG							
Temp F	Pressure psi	Gas vol MMSCFD	Comp CO_2 H_2S	Inject Rate lb/day	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
100	1150	4 6	72 28	528233	543 46	0 54	4 54	15562	2772

CONDITIONS AT BOTTOM OF WELL

Injection Zone Conditions					TAG				
Temp F	Pressure[3] psi	$Depth_{top}$ ft	$Depth_{bottom}$ ft	Thickness[4] ft	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
100	3376	8710	9100	280 00	879 04	0 88	7.34	9621	1714

CONDITIONS IN RESERVOIR AT EQUILIBRIUM

Injection Reservoir Conditions					TAG				
Temp[5] F	Pressure[3] psi	Ave Porosity[6] %	Swr	Porosity ft	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
124	3376	6 0	0 45	9 2	809 02	0 81	6 76	10454	1862

CONSTANTS

	SCF/mol	
Molar volume at STD	0 7915	
	g/mol	lb/mol
Molar weight of H_2S	34 0809	0 0751
Molar weight of CO_2	44 0096	0 0970
Molar weight of H_2O	18 015	0 0397

[1] Density calculated using AQUAlibrium software
[2] Specific gravity calculated assuming a constant density for water
[3] PP is taken from well tests of Linam AGI #1
[4] Thickness is the net thinckness of the perforated intervals
[5] Reservoir temp is extrapolated from bottomhole temp measured in logs
[6] Porosity is estimated using geophysical logs from nearby wells
H_2S concentration and ratio of H_2S and CO_2 in TAG as calculated in H2S Contingency Plan

CALCULATION OF MAXIMUM INJECTION PRESSURE LIMITATION

SG_{TAG}	0 71
$PG = 0\ 2 + 0\ 433\ (1\ 04\text{-}SG_{TAG})$	0 342 psi/ft
IP_{max} = PG *Depth	2982 psi

Where: SG_{TAG} is specific gravity of TAG, PG is calculated pressure gradient, and IP_{max} is calculated maximum injection pressure

CALCULATION OF 30 YEAR AREA OF INJECTION

Cubic Feet/day (5 6146 ft^3/bbl)	10454 ft^3/day
Cubic Feet/30 years	114548337 ft^3/30 years
Area = V/Net Porosity (ft)	12435387 ft^2/30 years
Area = V/Net Porosity (ft) (43560 ft^2/ac	285 5 acres/30 years
Radius =	1990 ft
Radius =	0 38 miles

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Pressure and Volume Injection Conditions under Current Assumptions

Table2· Pressure and Volume Calculations for TAG, Linam under Current Maximum Plant Capacity of 225 MMCFD and Measured Inlet Gas Concentrations

PROPOSED INJECTION STREAM CHARACTERISTICS

TAG	H_2S	CO_2	H_2S	CO_2	TAG
Gas vol MMSCFD	conc mol %	conc mol %	inject rate lb/day	inject rate lb/day	inject rate lb/day
7	18 4	81 6	122260	700156	822416

CONDITIONS AT WELL HEAD

Well Head Conditions		TAG							
Temp F	Pressure psi	Gas vol MMSCFD	Comp CO_2 H_2S	Inject Rate lb/day	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
104	1150	7	82·18	822416	339 96	0 34	2 84	38732	6898

CONDITIONS AT BOTTOM OF WELL

Injection Zone Conditions					TAG				
Temp F	Pressure[3] psi	$Depth_{top}$ ft	$Depth_{bottom}$ ft	Thickness[4] ft	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
104	3376	8710	9100	280 00	879 04	0 88	7.34	14979	2668

CONDITIONS IN RESERVOIR AT EQUILIBRIUM

Injection Reservoir Conditions					TAG				
Temp[5] F	Pressure[3] psi	Ave Porosity[6] %	Swr	Porosity ft	Density[1] kg/m^3	SG[2]	density lb/gal	volume ft^3	volume bbl
124	3376	6 0	0.45	9 2	809 02	0 81	6 76	16276	2899

CONSTANTS

	SCF/mol	
Molar volume at STD	0 7915	
	g/mol	lb/mol
Molar weight of H_2S	34 0809	0 0751
Molar weight of CO_2	44 0096	0 0970
Molar weight of H_2O	18 015	0.0397

CALCULATION OF MAXIMUM INJECTION PRESSURE LIMITATION

SG_{TAG}	0 61
$PG = 0\ 2 + 0\ 433\ (1\ 04\text{-}SG_{TAG})$	0 386 psi/ft
IP_{max} = PG *Depth	3366 psi

Where SG_{TAG} is specific gravity of TAG; PG is calculated pressure gradient; and IP_{max} is calculated maximum injection pressure

CALCULATION OF 30 YEAR AREA OF INJECTION

Cubic Feet/day (5 6146 ft^3/bbl)	16276 ft^3/day
Cubic Feet/30 years	178342498 ft^3/30 years
Area = V/Net Porosity (ft)	19360892 ft^2/30 years
Area = V/Net Porosity (ft) (43560 ft^2/acre	444.5 acres/30 years
Radius =	2482 ft
Radius =	0 47 miles

[1] Density calculated using AQUAlibrium software
[2] Specific gravity calculated assuming a constant density for water
[3] PP is taken from well tests of Linam AGI #1
[4] Thickness is the net thinckness of the perforated intervals
[5] Reservoir temp is extrapolated from bottomhole temp measured in logs
[6] Porosity is estimated using geophysical logs from nearby wells

Note that total Mass of H2S remains constant -- for this reason ROE in H2S Contingency Plan Remains the Same

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Comparison of Original Assumptions and Current Conditions of AGI Operation

SUMMARY OF COMPARISON OF ORIGINAL LINAM AGI #1 ASSUMPTIONS AND PROJECTED OPERATIONAL CONDITIONS

	MAXIMUM PLANT THROUGHPUT (MMCFD)	CONCENTRATION OF H2S IN INLET GAS (MOL%)	CONCENTRATION OF CO2 IN INLET GAS (MOL%)	COMBINED TAG VOLUME (MMCFD)	H_2S TAG VOLUME (MMCFD)	CO_2 TAG VOLUME (MMCFD)	$CO_2 : H_2S$ RATIO IN TAG	100 PPM ROE AT PLANT (FT)	500 PPM ROE AT PLANT (FT)	100 PPM ROE AT WELL AND PIPELINE (FT)	500 PPM ROE AT WELL AND PIPELINE (FT)	INJECTION ZONE AFFECTED AREA (ACRES)
1. EXISTING ASSUMPTIONS IN APPROVED H_2S PLAN	225 0	0 6	1 5	4 6	1 3	3 3	3 0	8877	4057	8914	4073	286 0
2. CURRENT ASSUMPTIONS BASED ON INLET GAS AND EXPANSION PROJECT	225 0	0 6	2 5	7 0	1 3	5 7	3 4	8877	4057	8914	4073	445 0

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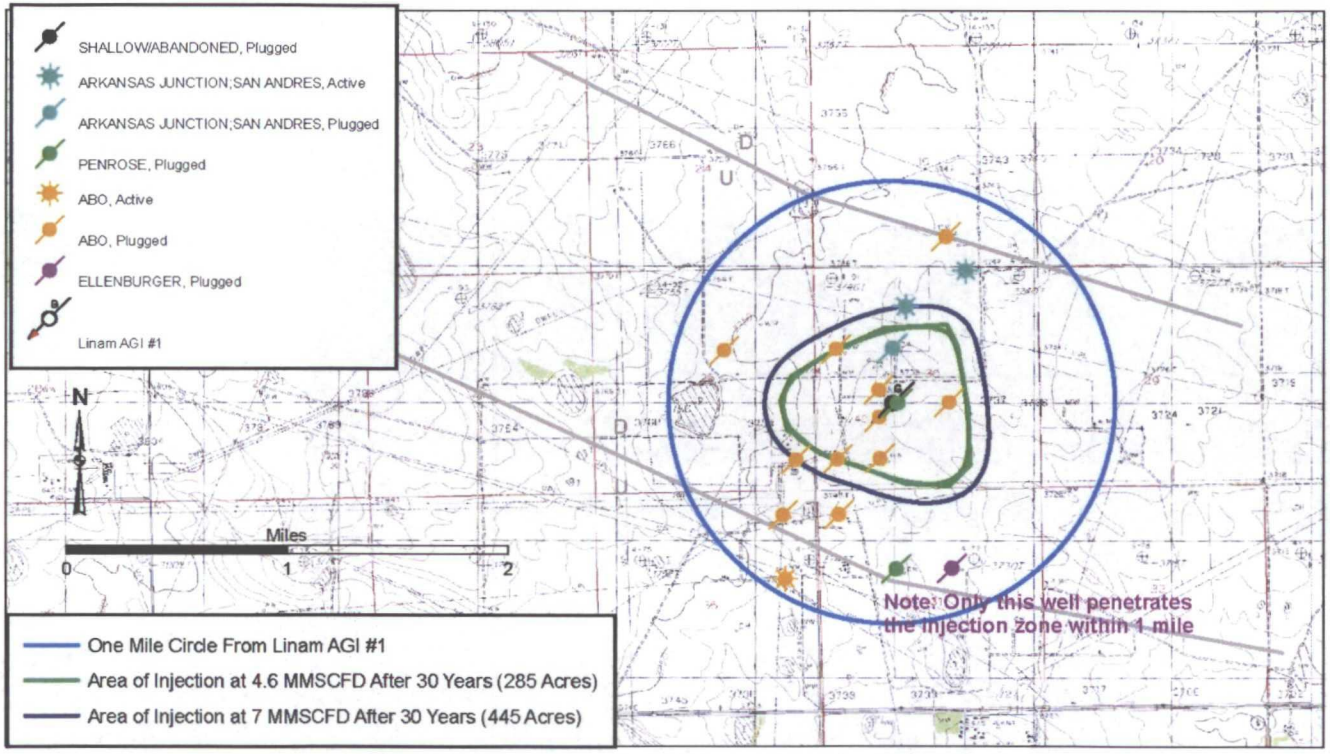
Effect of Additional TAG Injection on Injection Zone



Original versus Planned Maximum Footprints of Injected TAG, Linam AGI #1

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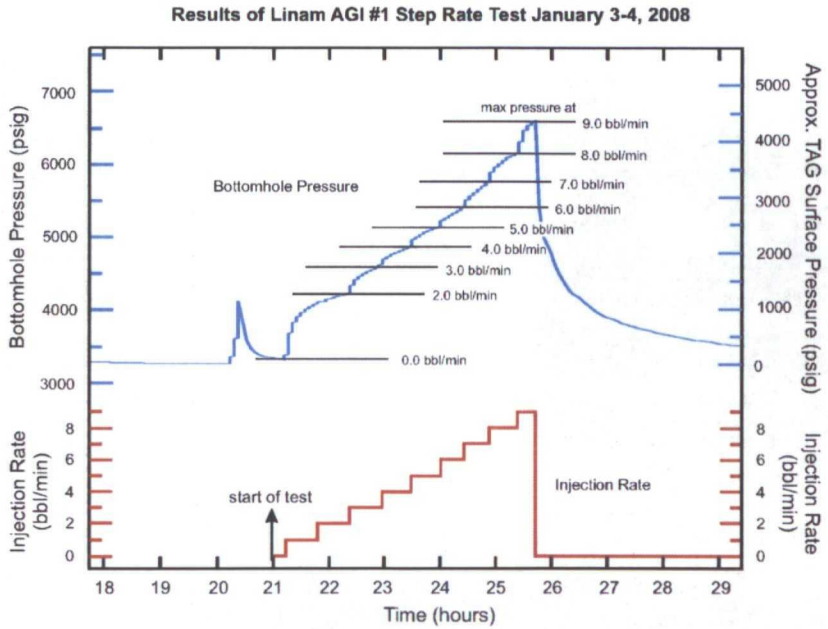
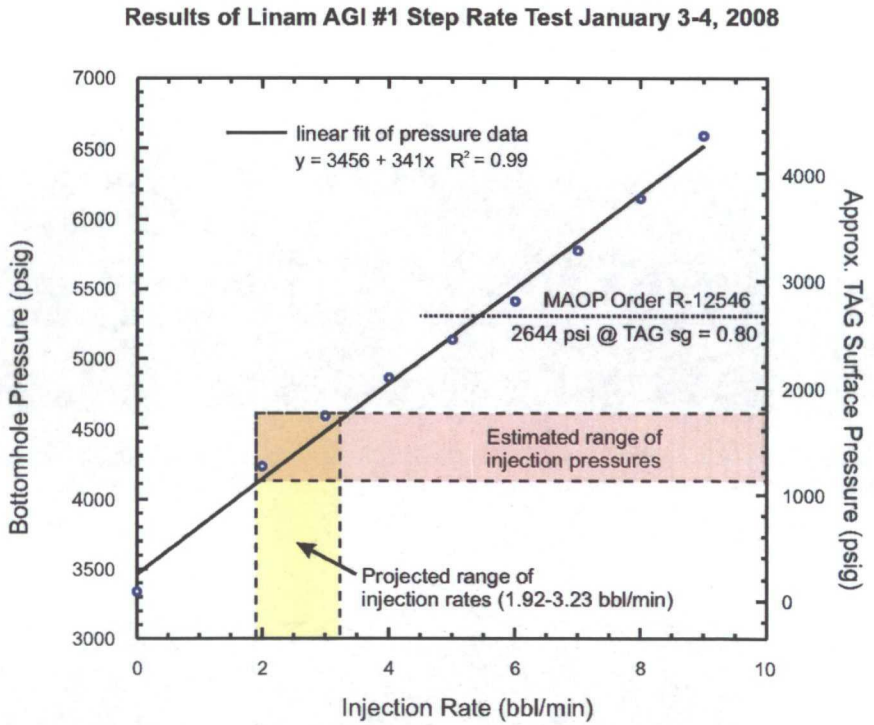
Step Rate Test Performed in January 2008 Clearly Demonstrates that Original MAOP and Unlimited Injection Rate is Appropriate



Note: Approx. TAG Surface Pressure is calculated using the initial reservoir pressure (3262 psi) and the ave. specific gravity of TAG (0.69)



Note: Approx. TAG Surface Pressure is calculated using the initial reservoir pressure (3262 psi) and the ave. specific gravity of TAG (0.69)

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Step Rate Test Results

- Step rate test conducted after completion of well in January 2008
- Step rate test supports safe injection pressures which are significantly higher than the 2644 MAOP in original order
- No breaks were detected in pressure curve at injection rates of up to TAG equivalents in excess of 20MMCFD

Summary

- Original order R-was based on detailed analysis by NMOCD and after a public hearing in front of the NMOCC
- MAOP of 2644 and unlimited injection rate of TAG is appropriate in this case
- Step rate test supports a significantly increased pressure without any negative effects on injection formation or caprock
- No revision of H2S contingency plan is needed due to no increase in H2S concentration in inlet gas
- Injection history demonstrates injection reservoir is excellent and has ample capacity to accommodate increased TAG volumes