



February 23, 2012 NMOCC Follow Up Hearing, Case 14575



EXHIBIT 2

Presentation Goals

- ▶ Targa was granted authority to inject mixed acid gas and wastewater into Eunice Gas Plant SWD #1 by NMOCC Order R-12809-C
- ▶ Order required a follow up hearing
- ▶ At this hearing, Targa will:
 - Demonstrate compliance with all specific aspects of the order
 - Provide data and modeling to characterize the injection reservoir and proposed injection
- ▶ Based on information to be presented at this hearing, Targa requests that NMOCC modify the Order:
 - To authorize injection into Eunice Gas Plant SWD #1 for a lifespan of 30 years
 - To establish a MAOP based on anticipated mixture of 1600 psig
 - To authorize perforation of interval between 4210 and 4250 feet and injection into that interval

Demonstrated Compliance with Requirements of Order

1. Proof that well was completed to specifications of order (Section 4, End of Well Report; C-103s and C-105 in Appendix D, End of Well Report)
2. Proof of approved H₂S contingency plan (letter from NMOCD approving Plan, Appendix D, End of Well Report)
3. Proof that injection records (C-115 filings) have been submitted and are correct (Appendix B, End of Well Report)
4. Proof that remedial work on Langlie-Mattix Penrose Sand Unit Well No. 252 has been completed (C-103s in Appendix N, End of Well Report)
5. Record of open hole logs (Section 6.1 and Appendix F, End of Well Report)
6. Results of reservoir tests - step-rate test, tracer and temperature injection survey, and pressure transient test (Sections 6.3-6.4 and Appendix L, End of Well Report)

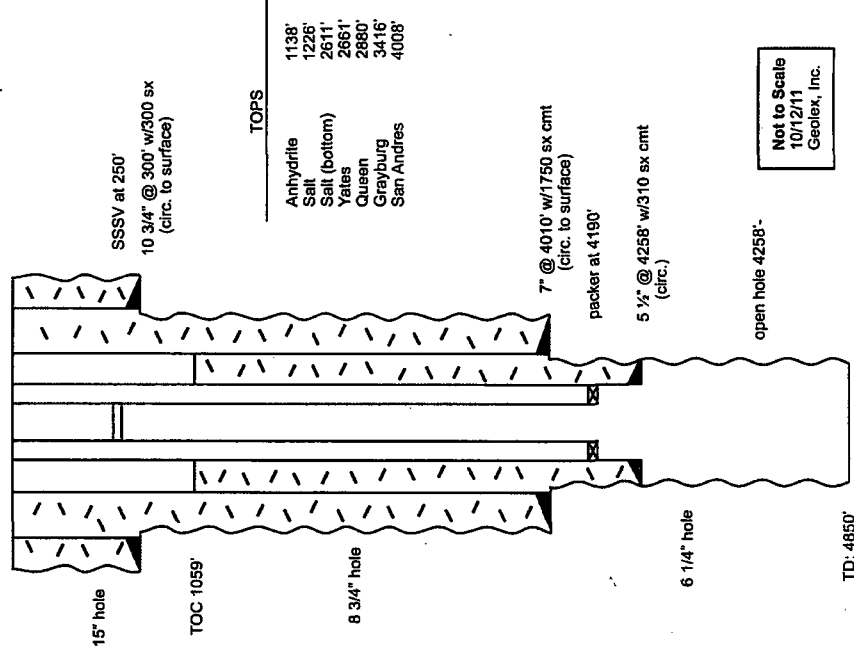
Demonstrated Compliance with Requirements of Order (continued)

7. Results of MIT (C-103 in Appendix D, End of Well Report)
8. Readings from meters and pressure gauges documenting injection of mixed acid gas and wastewater (C-115 filings in Appendix L, End of Well Report) (Includes Timeline for New Injection and Pressure Data Analysis)
9. "Operator's calculation of the time it will take for the acid gas plume to reach ½ mile from the disposal well" (Section 6.6, End of Well Report)
10. Request for establishment of a Maximum Allowable Operating Pressure based on results of step-rate test for the anticipated mixture (Section 6.3 and Appendix O, End of Well Report)
11. Request to perforate 4210-4250 foot interval and increase overall injection interval to 4210-4850 feet from 4250-4850 feet

1. Well Completed to Order Specifications

- ▷ Well completed May 23, 2011
- ▷ Specific requirements noted:
 - Permitted injection interval between 4250 ft and 4850 ft
 - Coated tubing to prevent corrosion
 - Subsurface safety valve to prevent backflow
 - Meters to record injection (not shown)
 - Pressure Gauges to monitor annulus fluid pressures (not shown)
- ▷ Details documented in C-105 submitted July 15, 2011

WELL NAME: Eunice Gas Plant SWD #1
 LOCATION: 2580' FSL & 1200' FWL Unit 1 Sec 27 T22S R37E
 GL: 3345' ZERO: KB:
 SPUD DATE: 10/26/61 RECOMPLETION DATE: 6/13/11
 COMMENTS: API #30-025-21497 PLUG DATE:



2. Approved H₂S Contingency Plan

- ▷ H₂S Contingency Plan approved by NMOCD in August 11, 2011

From: Jones, Brad A., EMNRD [mailto:brad.a.jones@state.nm.us]
Sent: Thursday, August 11, 2011 5:08 PM
To: Wrangham, Calvin W.
Subject: RE: Eunice Plan

The Oil Conservation Division has completed the review of the Targa Eunice Gas Plant and AGI Pipeline/Well site Hydrogen Sulfide (H₂S) Contingency Plan, dated August 11, 2011, and has determined it to be adequate. Targa Midstream Services, LLC has submitted a H₂S contingency plan that demonstrates compliance with the applicable provisions of 19.15.11 NMAC. Targa Midstream Services, LLC shall implement the H₂S Contingency Plan immediately and provide copies of the plan to the appropriate parties identified on the distribution list provided in Appendix B.

Thank you for your cooperation in resolving the H₂S contingency plan. The OCD appreciates all of the time and effort of you and your staff in making the appropriate revisions to the plan. If there are any questions regarding this matter, please do not hesitate to contact me at (505) 476-3487 or brad.a.jones@state.nm.us.

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3. Records of Injection (C-115) Prior to Recompletion Filed

- ▷ All injection records for Eunice Gas Plant SWD #1 during operation by Targa (prior to recompletion) were checked and corrected where appropriate
- ▷ Corrected volumes and pressures were submitted to NMOCD in December 2011 and are now accessible through C-115 filing database

4. Remedial Work on LMPSU Well #252

Completed

- ▷ Plans for remedial work on Langlie-Mattix Penrose Sand Unit Well No. 252 were filed as C-103 to NMOCD and approved April 28, 2011
- ▷ Remedial work was performed during May-June 2011, including:
 - Entering well
 - Drilling out plugs to 4073 feet
 - Plugging back to 3700 feet using retainer squeeze cementing or verified cement plugs
- ▷ Report on remedial work was filed as C-103 with NMOCD on June 8, 2011 and approved June 10, 2011

5. Open Hole Logging Performed

- ▷ Porosity and Resistivity Logs collected
- ▷ eXtended Range MicroImager (XRFMI) Logs collected (not required by Order)
- ▷ Logs submitted to NMOCD with C-103 on June 21, 2011
- ▷ Results and interpretations submitted to NMOCD in End of Well Report, will be presented later in this hearing

6. Reservoir Tests Performed

- ▶ Step-Rate Test (SRT) performed in July 2011
- ▶ Pressure transient “falloff” testing performed in July 2011
- ▶ Tracer survey performed on July 14, 2011
- ▶ Two temperature surveys performed, one accompanying SRT, one following tracer survey
- ▶ Results and interpretations of reservoir testing submitted to NMOCD in End of Well Report, will be presented later in this hearing

7. Mechanical Integrity Test Results

- ▶ Satisfactory MIT was performed on June 29, 2011
- ▶ Documented in C-103 submitted to NMOCD on July 1, 2011 and approved July 6, 2011 and in End of Well Report, Appendix D
- ▶ Second MIT completed after packer seal leak was repaired on September 21, 2011

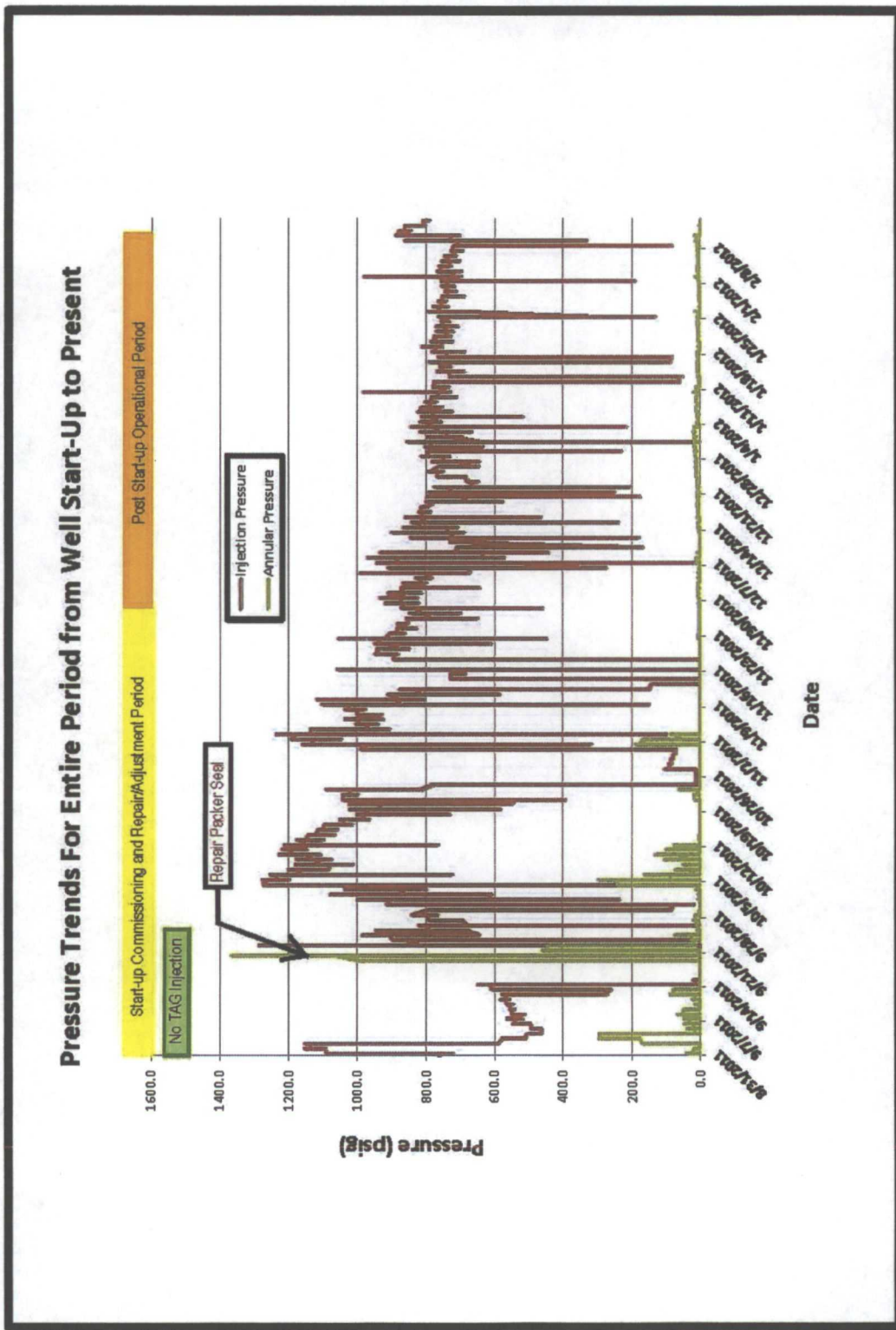
8. Injection Records for New Injection

- ▶ Topside facilities have been completed and injection commenced on August 24, 2011, as documented in a letter to NMOCD Readings from meters and pressure gauges documenting injection of mixed acid gas and wastewater reported using C-115 filing system
- ▶ Data for Start-up and Post-Startup Periods included here for analysis
- ▶ Initial packer seal leak (fixed in 9/2011) and compressor control issues are reflected in initial injection period data

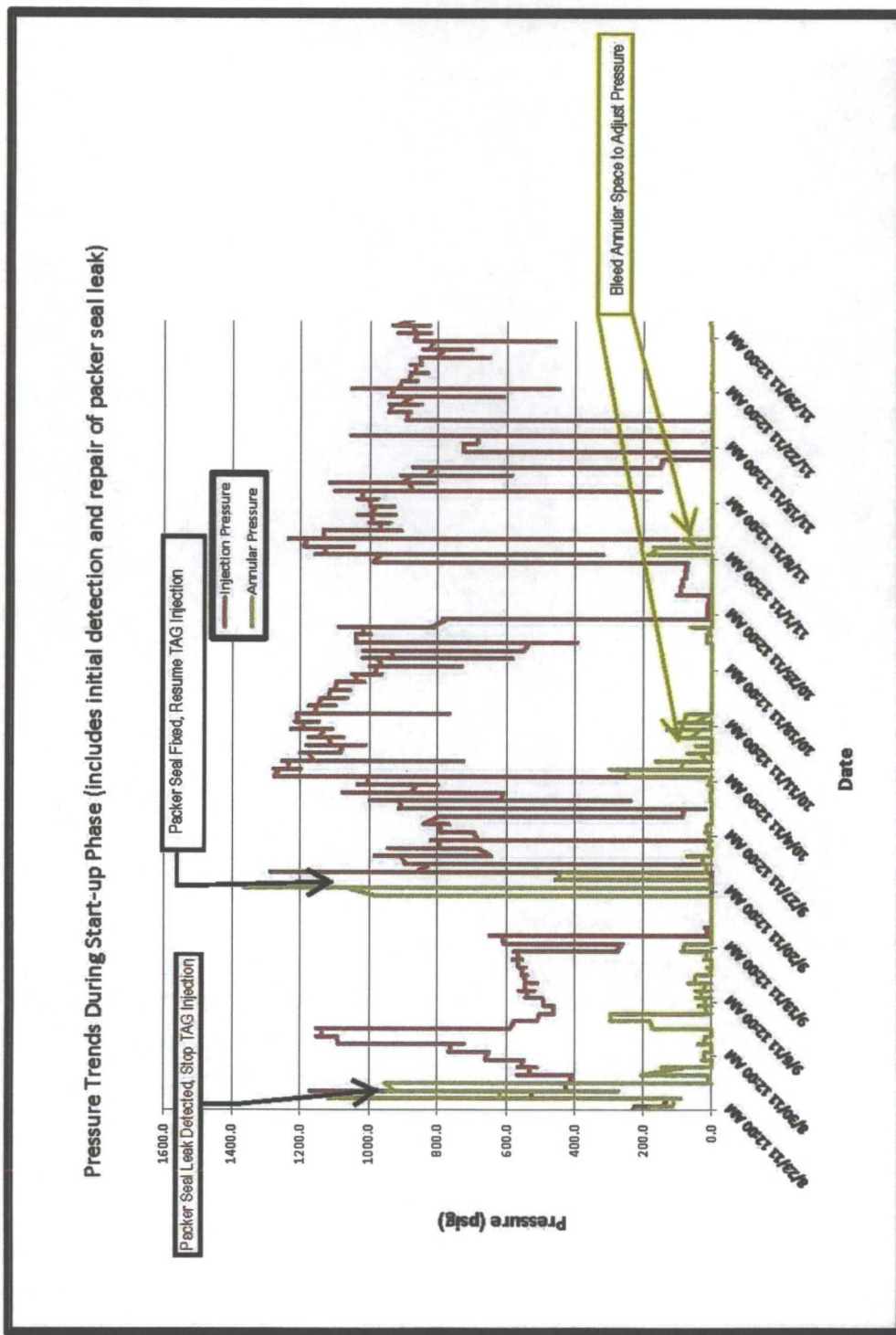
8. Timeline for Well Activities Since Completion

- ▶ Initial Startup on August 24, 2011 of TAG with wastewater
- ▶ August 26-29, 2011 Possible tubing or packer leak detected, stopped injecting TAG on 8/26/11
- ▶ August 29, 2011 notified OCD Hobbs and OCD Santa Fe
- ▶ September 19-21 Pulled and tested tubing, no leak; found and repaired packer seal leak by redressing packer seals
- ▶ New MIT performed on well successfully on September 21, 2011
- ▶ Resumed mixed TAG/wastewater injection on September 23, 2011
- ▶ Startup period included many compressor control issues which resulted in multiple compressor shutdowns
- ▶ TAG routed to SRU during shutdowns, wastewater injection continued
- ▶ Annular space pressure due to temperature effects bled to maintain near zero pressure in October and November
- ▶ Annular space pressure confirms that leak was fully repaired, has maintained near zero pressure with only temperature and atmospheric pressure variations since December 1, 2011
- ▶ Compressor controls are being fine tuned to prevent shutdowns

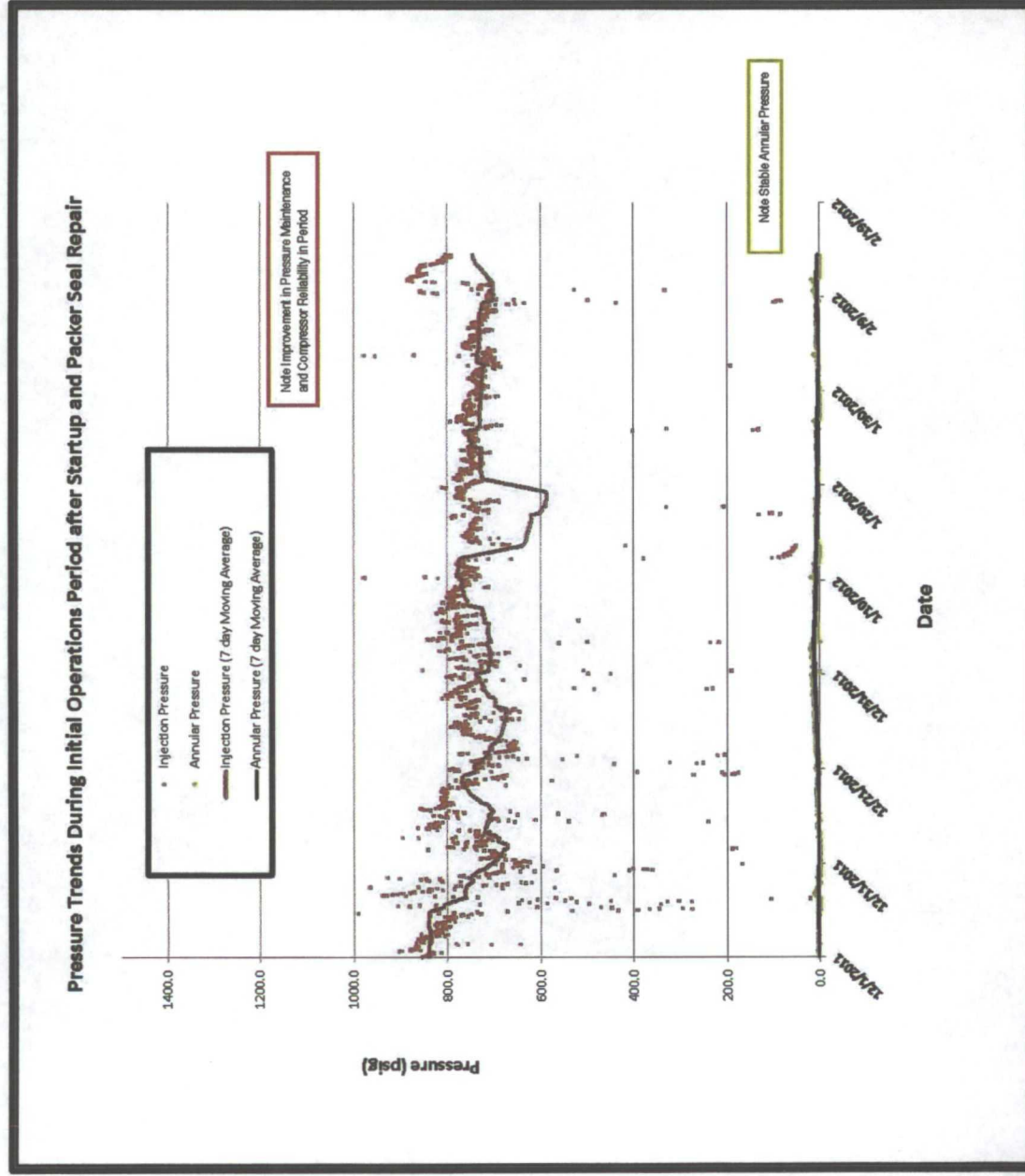
8. Injection Records for New Injection



8. Injection Records for New Injection (cont.)



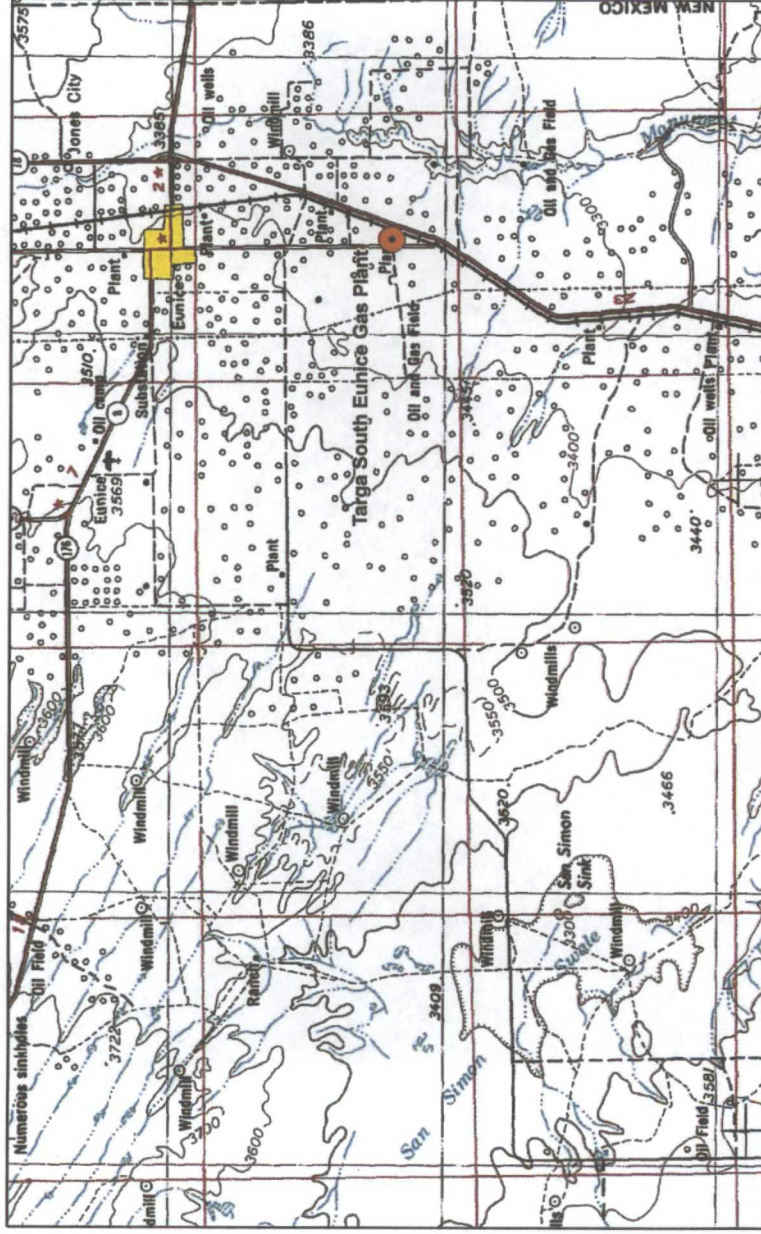
8. Injection Records for New Injection (cont.)



9. Injection Plume Modeled

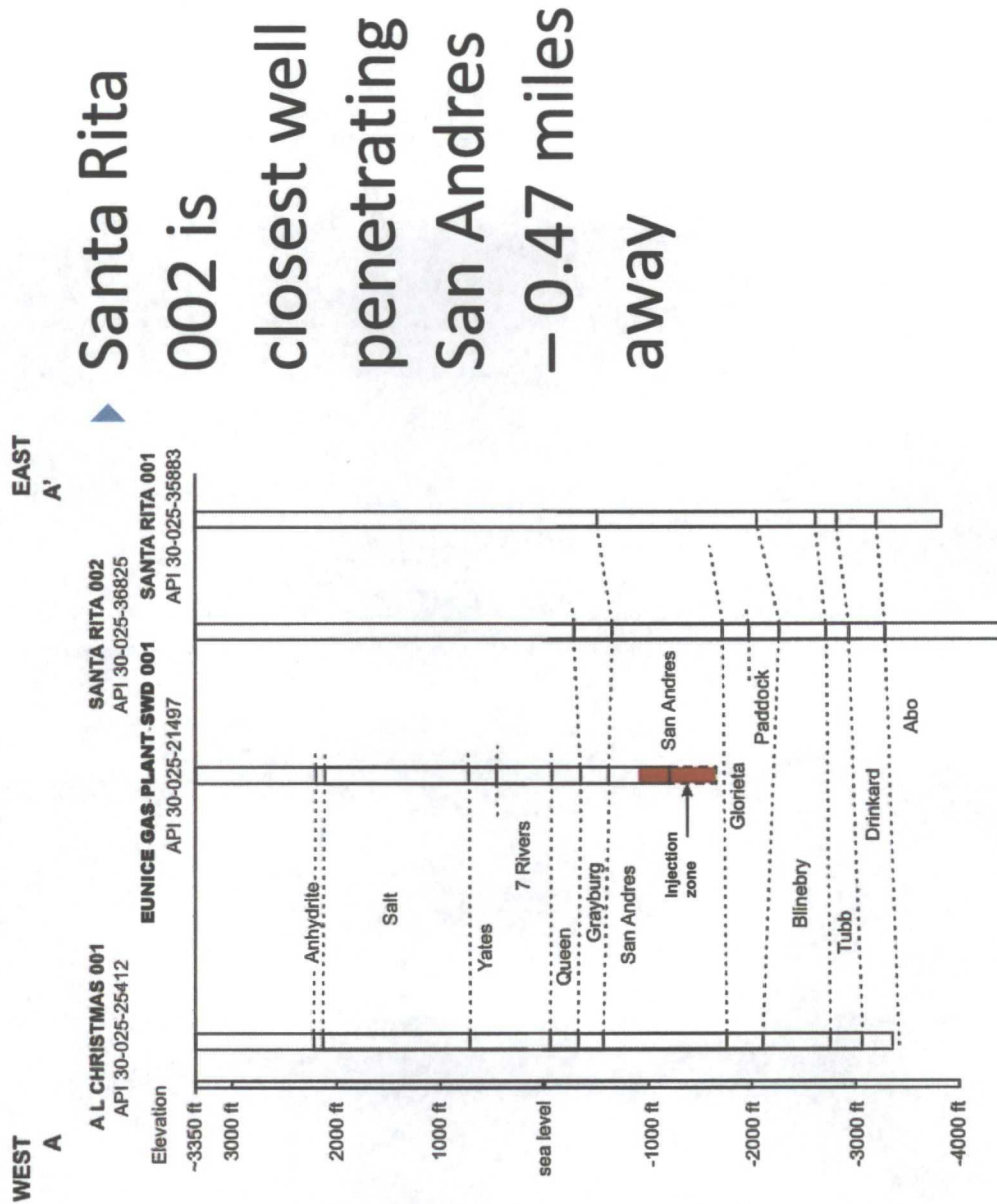
- ▶ Results from geophysical logs, XRF logs, sidewall cores and reservoir tests were analyzed to characterize the geology and injectivity of the injection reservoir
- ▶ Using this data, a model was developed to calculate the distribution of the injection plume over time
- ▶ Results and interpretations of injection plume modeling submitted to NMOCD in End of Well Report, will be presented later in this hearing

Location of Targa's Eunice Gas Plant SWD #1 Well



Stratigraphy at Eunice Gas Plant SWD #1

- Approved injection into the San Andres Formation (4250-4850 ft depth)
- Prior injection through well into San Andres (4050-4550 ft)



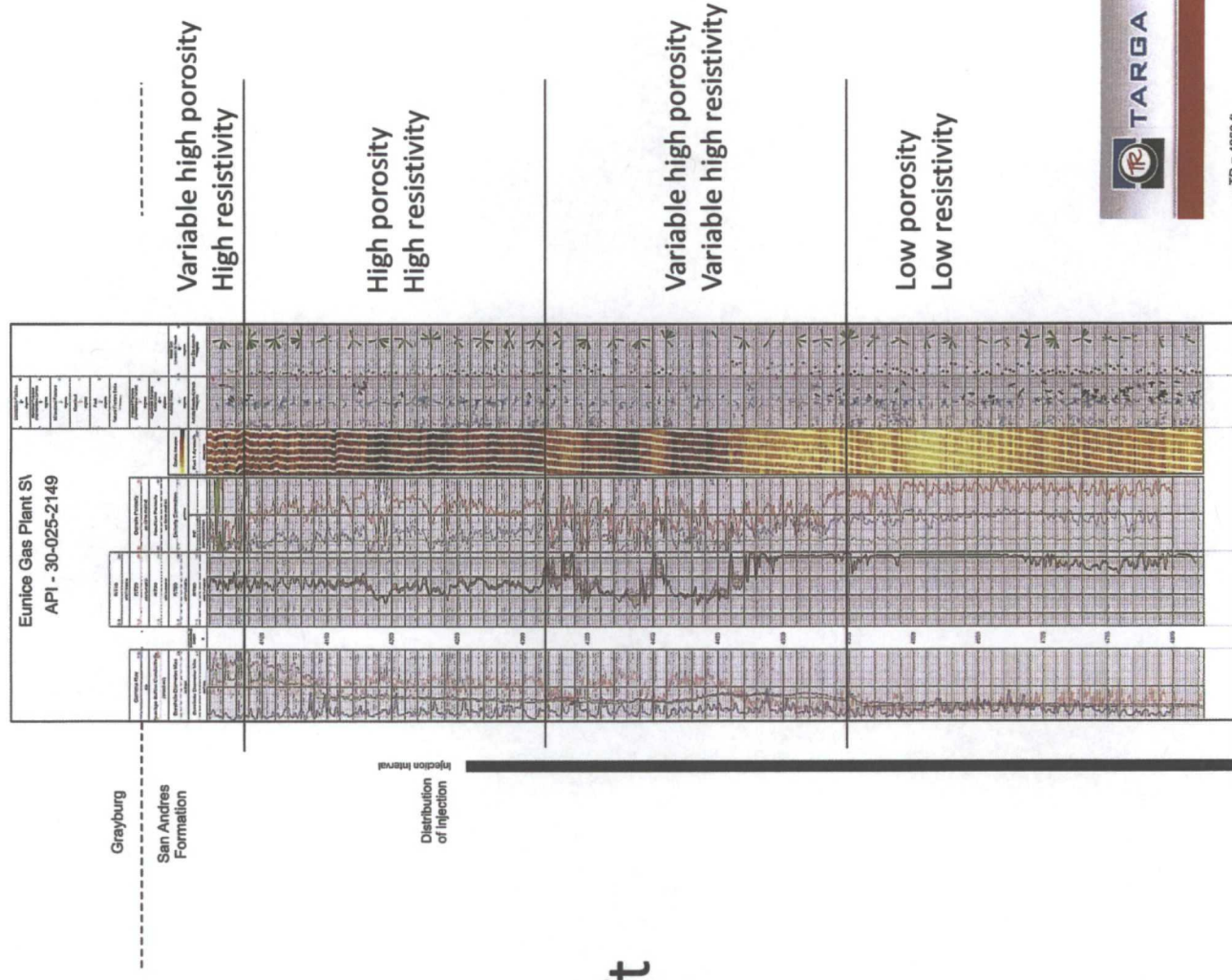
- Santa Rita 002 is closest well penetrating San Andres – 0.47 miles away

Summary of Reservoir Testing & Characterization

- ▶ Geophysical Logs – collected for 4050 ft – 4850 ft depth
 - Porosity and resistivity
 - eXtended Range MicroImager (high resolution resistivity)
- ▶ Sidewall Cores – 32 samples collected between 4195 ft and 4826 ft depth
 - Porosity and air permeability determined in laboratory for all samples (except those too fractured for analysis)
 - Irreducible water and water and CO₂ permeability determined in laboratory on selected samples
- ▶ Step-Rate Test – performed at 0.5 – 5.0 bbl/min
- ▶ Transient Pressure/Falloff Tests – performed at 1.5 and 3.0 bbl/min
- ▶ Tracer Survey – performed at 1.5 and 3.0 bbl/min
- ▶ Temperature Surveys – performed during SRT and following tracer surveys

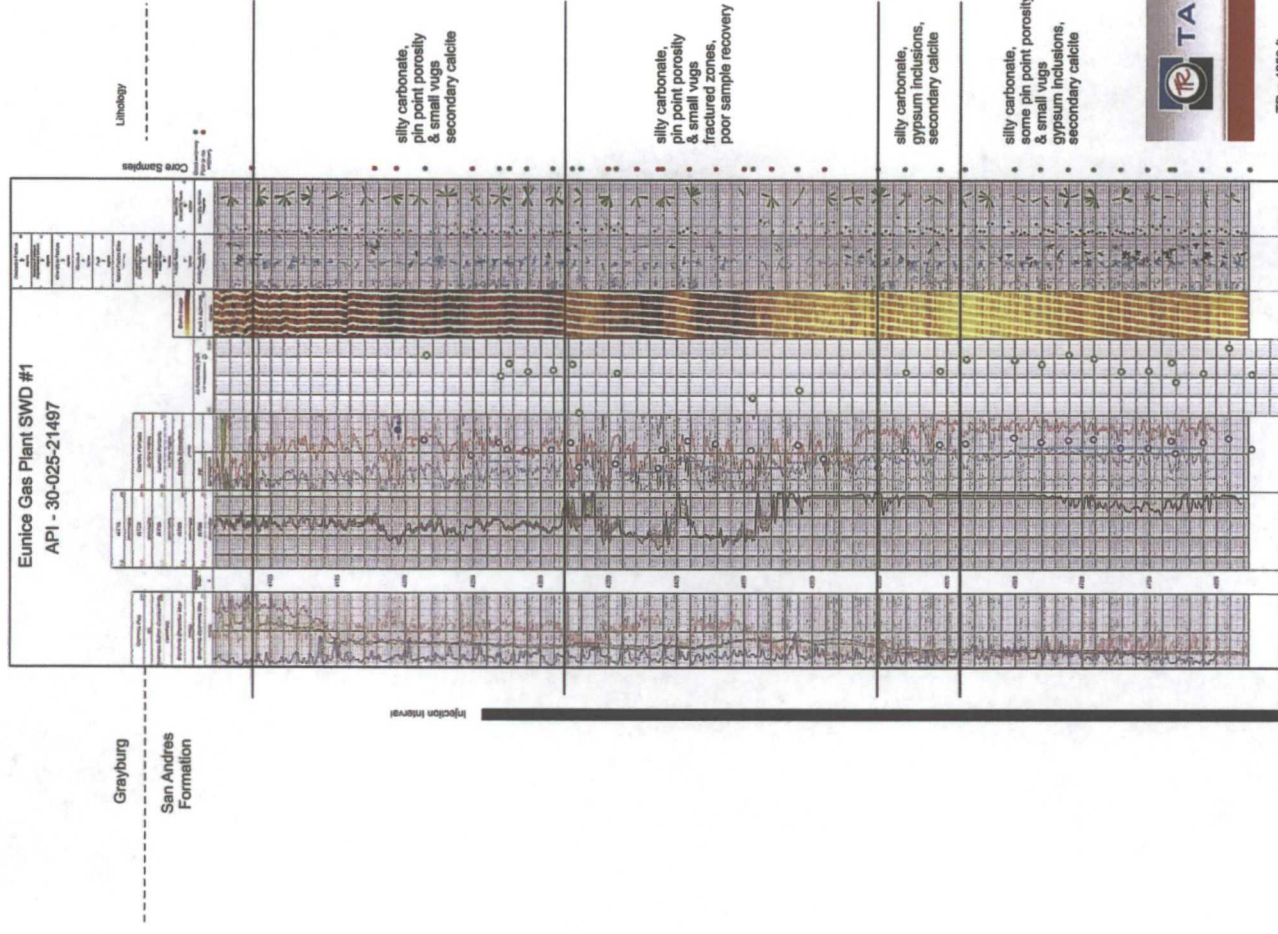
Geophysical Logs

- ▶ Revealed four zones of distinct resistivity and porosity
- ▶ Relatively high porosities (up to ~20% cross plot) restricted to above 4500 ft
- ▶ Low porosities (average ~4.5% cross plot) below 4500 ft
- ▶ No faults or microfaults identified in section



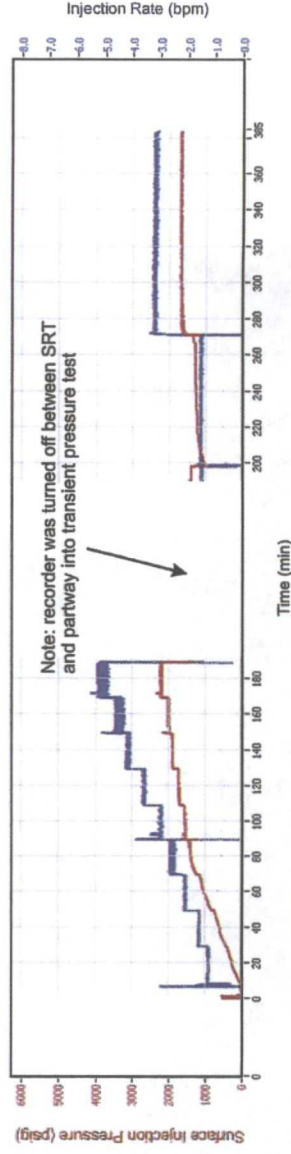
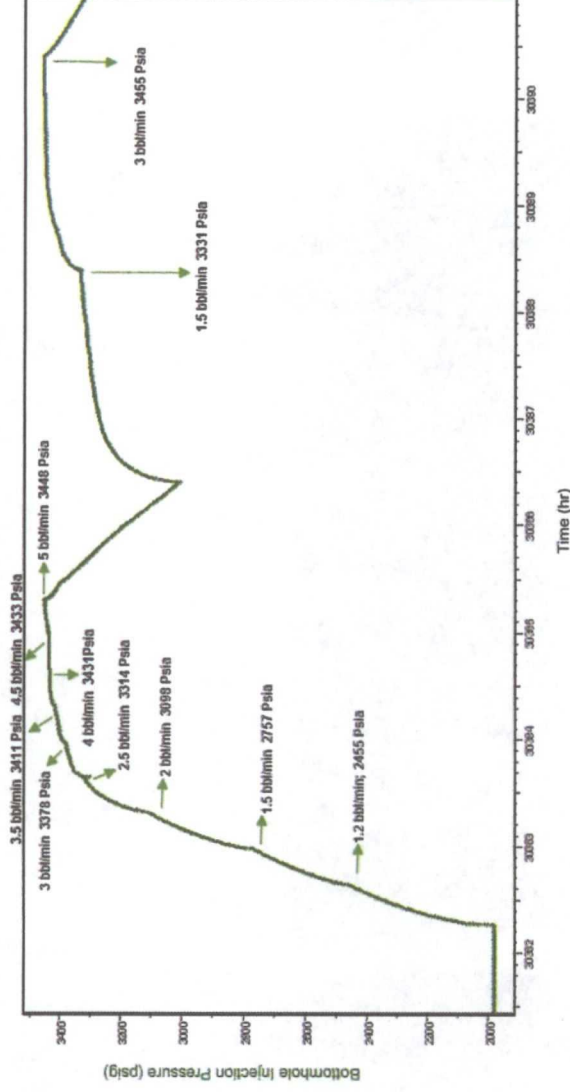
Sidewall Cores

- ▶ Samples above 4550 ft have well developed vuggy and pin point porosity – poor sample recovery
- ▶ Samples below 4550 ft have poorly developed pin point porosity with secondary calcite and anhydrite
- ▶ Laboratory analyses show:
 - Porosity ranging from ~2 to 38%, air permeability from 0.003 to 9 mD
 - Irreducible water from 0.32 (above 4550 ft) to ~0.60 (below 4550 ft)



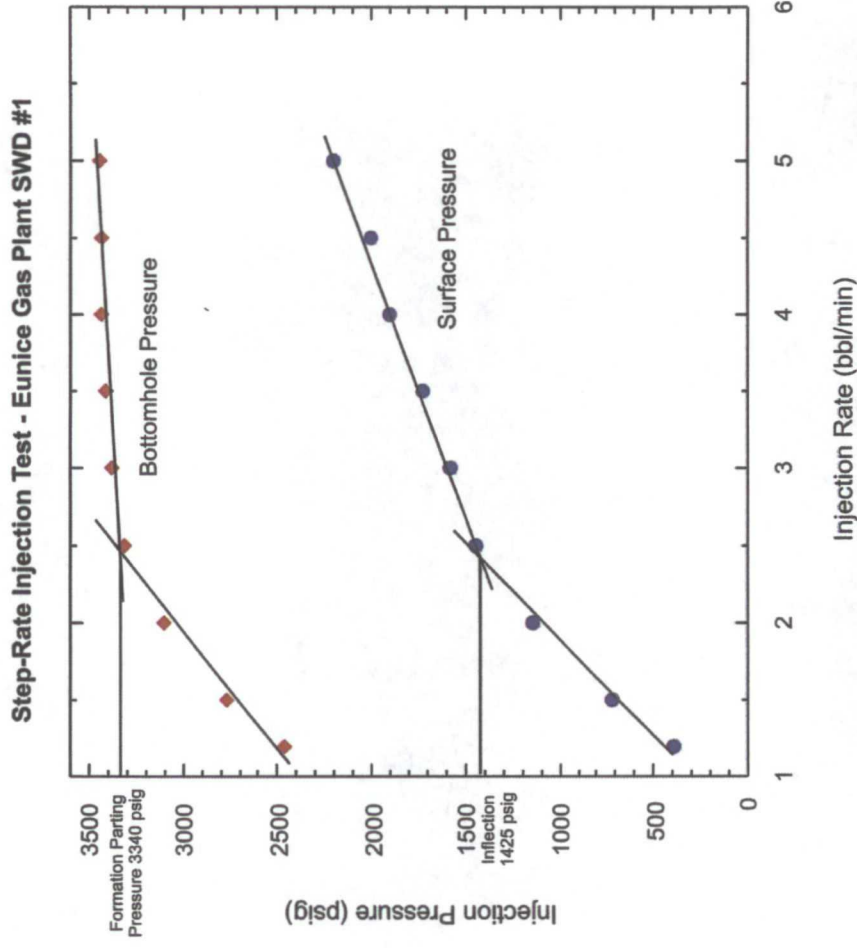
Step-Rate Test

- ▶ Background reservoir pressure of 1980 psig
- ▶ Maximum reservoir pressure of 3448 psig at 5 bbl/min
- ▶ Notable increase in injectivity at 2.5 bbl/min



Step-Rate Injection Test Results and MAOP

- ▶ Inflections in bottomhole and surface pressure curves
- ▶ Bottomhole inflection consistent with formation parting pressure of 3340 psig – consistent with strength of limestone
- ▶ Surface pressure curve based on injection of pure water – not appropriate for mixed or pure TAG injection
- ▶ Relationship between pressure and injection fluid specific gravity (mixture composition) will be discussed later during this hearing



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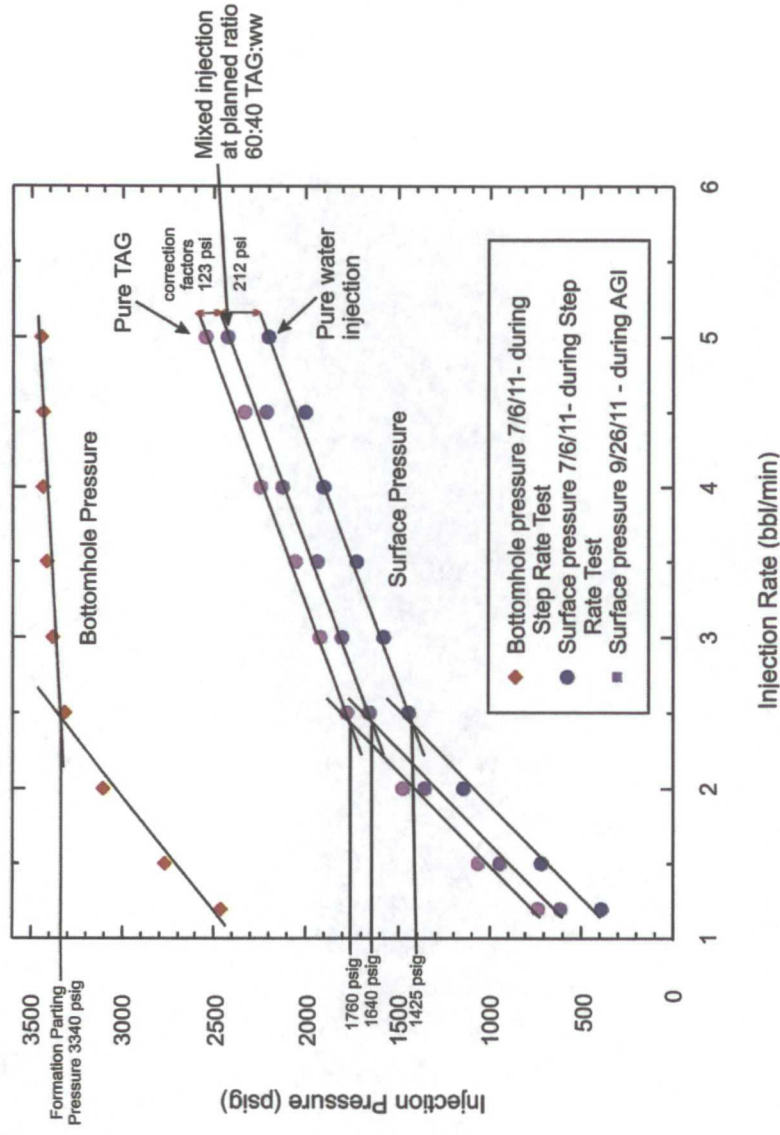


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Step-Rate Test Results and MAOP Using Average TAG/Water Injection Mixtures

- ▶ Surface pressure curves can be corrected for different SG_{if}
- ▶ Request MAOP increase to:
 - 1600 psig for planned ratio (60:40)



Correction factors:

Pure TAG: 335 psig $SG_{if} = 0.83$

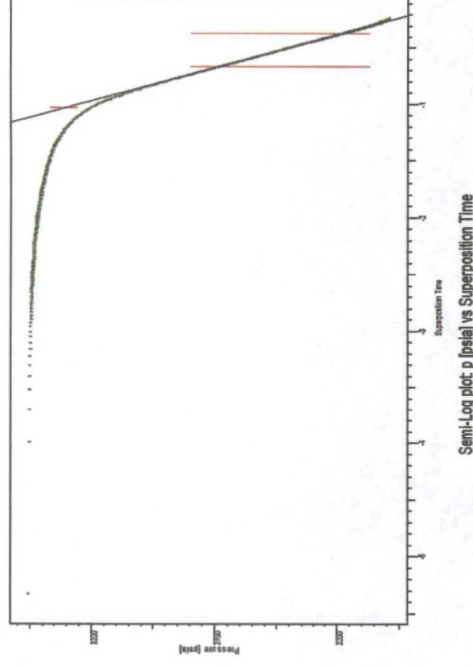
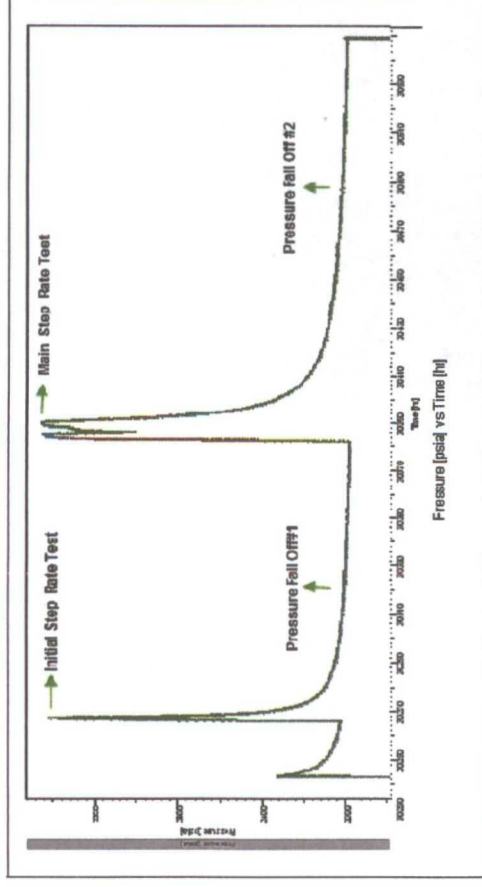
60:40 TAG:ww: 212 psig $SG_{if} = 0.89$

Pure ww: 0 psig $SG_{if} = 1.01$

● ● Increase in Maximum Operating Pressure Justified with OCD-Witnessed SRT

- ▶ Current MAOP - 1300 psig
 - Based on mixed injection ~60 Vol% TAG and 40 Vol% wastewater
- ▶ Using SRT results This mixture works out to ~1640 psig based on SRT
- ▶ As mixture changes, so does SG of injection fluid and resultant hydrostatic head
 - Higher percentage TAG results in lower SG and greater injection pressure required to result in same bottomhole pressure
- ▶ Request approved MAOP increase to 1600 based on mixture with safety factor built in based on OCD-witnessed Step Rate Test
 - For 60:40 TAG:wastewater mixture and greater TAG ($SG_{if} \sim 0.83-0.89$), request MAOP of 1600 psig

Transient Pressure and Falloff Test

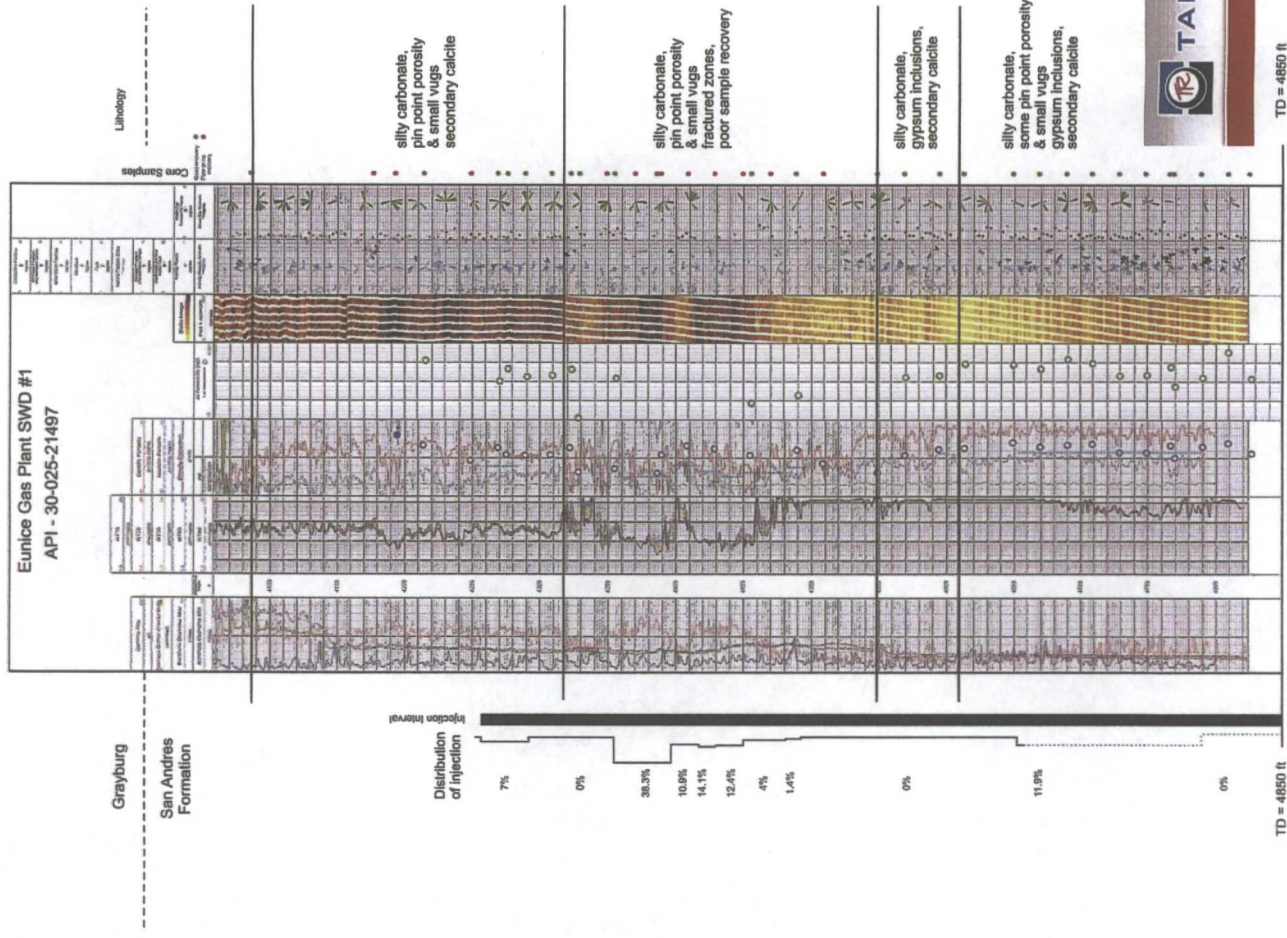


Modeling of pressure falloff showed:

- Effective permeability $k = 0.745$ mD
- Transmissivity $T = 447$ mD·ft

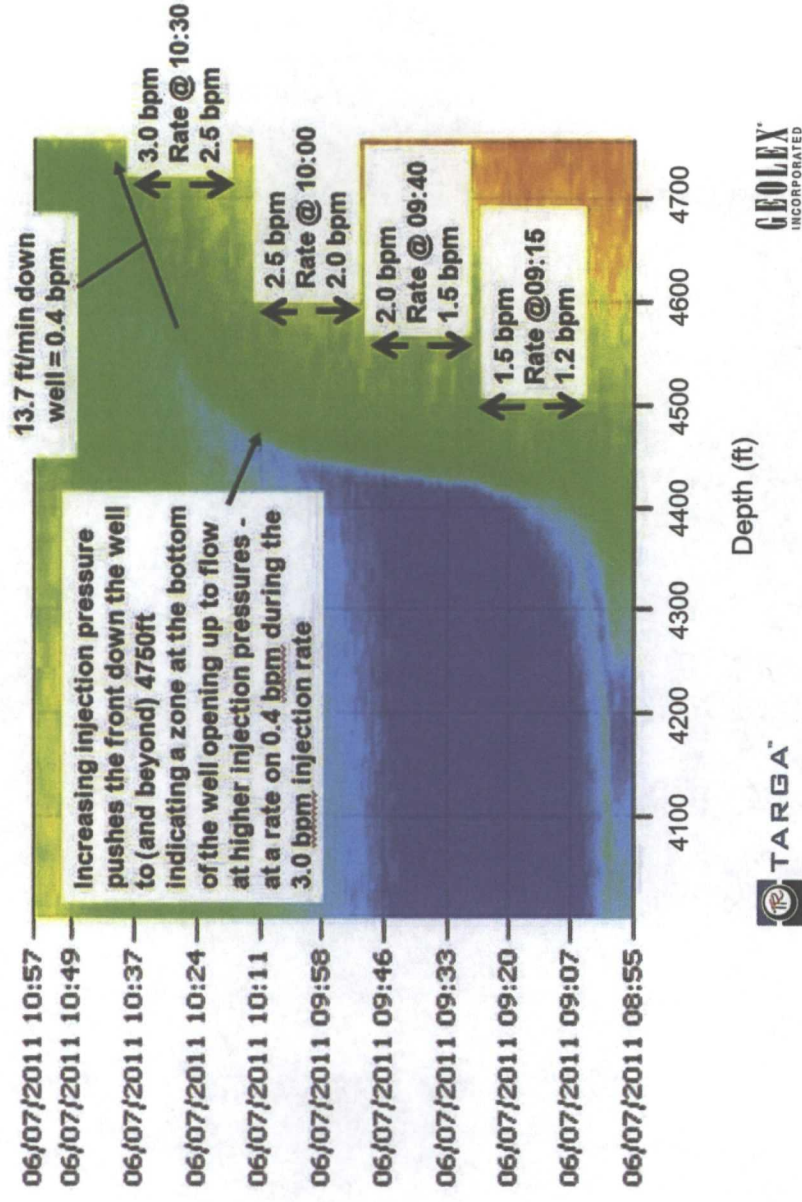
Tracer Survey

- ▶ Injectivity greatest above 4500 ft
- ▶ Zone of injection extends to greater depth at 3 bbl/min
- ▶ At 3 bbl/min
 - Total thickness accepting injection 302 ft, 51% of total injection zone
 - High injectivity 4355 - 4494 ft
 - Some injectivity 4258-4284 ft, 4653-4790 ft
 - No injection 4284-4355 ft, 4494-4653 ft, below 4790 ft



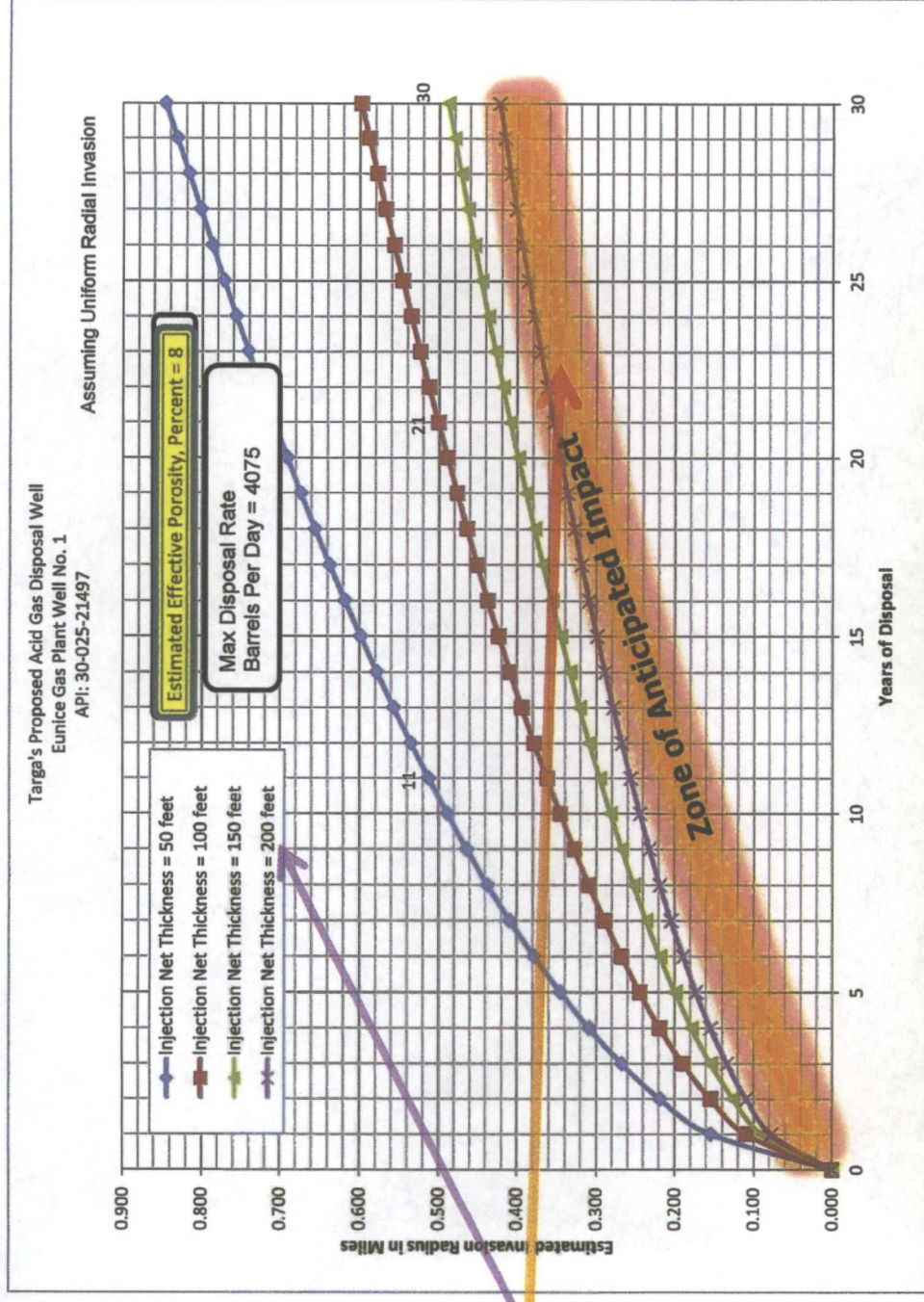
Temperature Surveys #1 and #2

- ▶ Reservoir temperature of 79-88°F
- ▶ Injectivity greatest above 4500 ft
- ▶ Zone of injection extends to 4750 feet at 3 bbl/min
- ▶ Temperature surveys and tracer survey consistent



Effect of Average Porosity of Zone and Injection at Proposed Maximum Rate

- ▶ **OCD Exhibit underestimates effective porosity and thickness of zone accepting injection**
- ▶ **Average Porosity of zone accepting fluid is 11%**
- ▶ **Zone accepting fluid is 302 ft. thick**
- ▶ **Net porosity of zone accepting fluid is 18.3 ft. based on net porosity after accounting for Sw**



Modified from OCD Exhibit 3 in pre-hearing statement
And incorporates data from Geolex End of Well report
Figures 9, 10, 11 and text in Section 6.6 p.21

Summary of Findings

- ▷ Reservoir conditions 83°F and 1980 psi
- ▷ Formation parting pressure of 3340 psig at reservoir depth
 - This corresponds to a surface injection pressure of 1640 psig for mixed acid gas and wastewater
- ▷ Roughly 50% of section accepts fluid during injection
 - Injection concentrated in high porosity (up to 20%) limestone above 4500 feet depth
 - Limited injection into low porosity (~4.5%) limestone below 4500 feet depth
- ▷ No evidence of faulting or lateral continuous features conducive to preferential flow

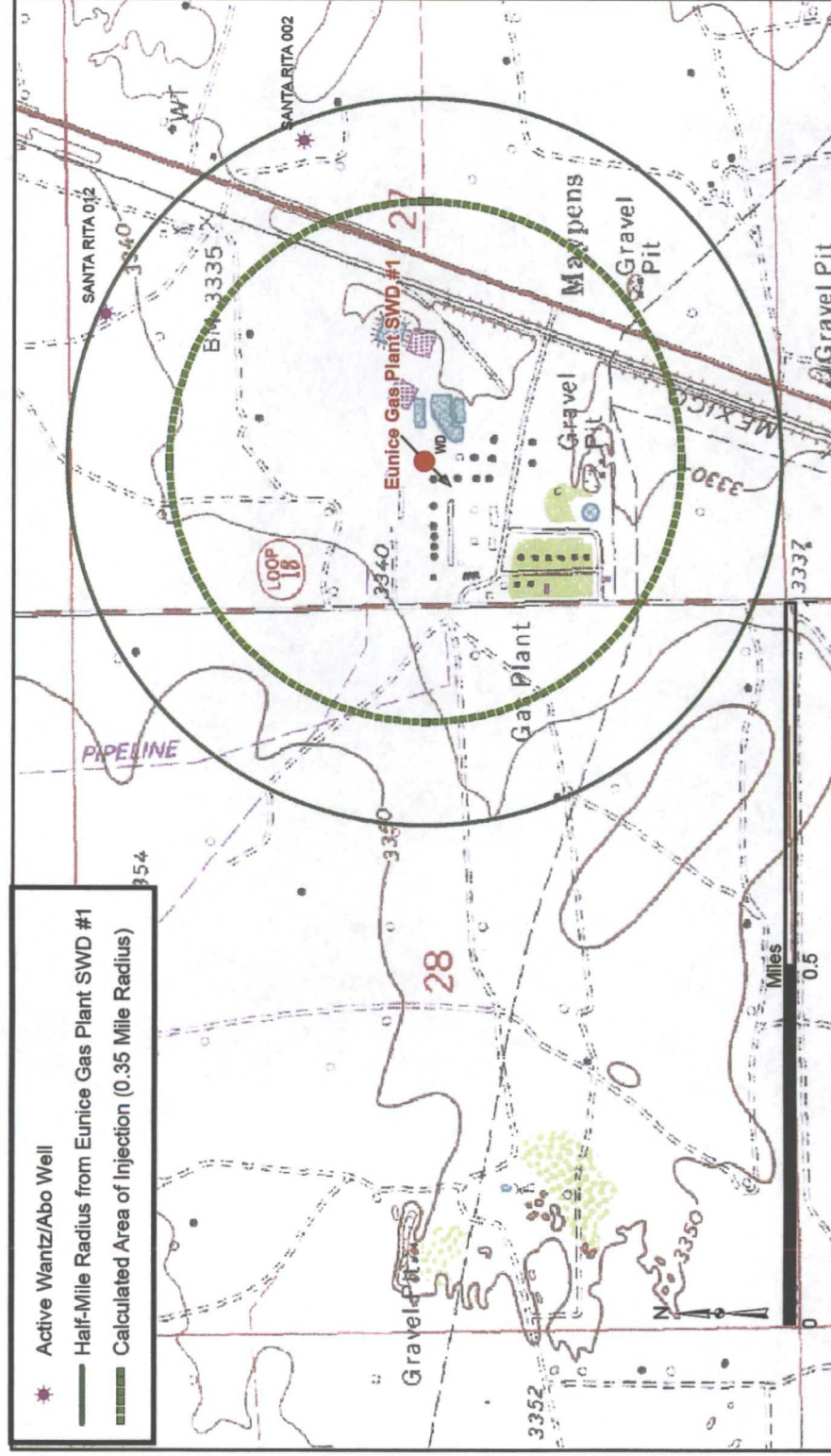
Calculation of Average Properties for Zone Accepting Fluid in San Andres

	Segment	Fluid Injection Into Segment	Top	Bottom	Thickness	Porosity Neutron (L)	Porosity Density (L)	Porosity XPlot	S _{wir} Lab	Porosity Net
		% Total Injection	ft depth	ft depth	ft	%	%	%		ft
Top half of	1	7.0	4258	4284	26	20.2	5.9	13.0	0.320	2.3
injection	2	38.3	4355	4398	43	25.0	14.2	19.5	0.320	5.7
reservoir	3	10.9	4398	4418	20	16.0	10.1	13.0	0.320	1.8
	4	14.1	4418	4431	13	22.4	11.1	16.5	0.320	1.5
	5	12.4	4431	4451	20	25.1	13.1	19.0	0.320	2.6
	6	4.0	4451	4482	31	20.6	13.1	16.5	0.320	3.5
	7	1.4	4482	4494	12	19.2	8.4	13.5	0.320	1.1
Bottom half	8	11.9	4653	4790	137	11.1	-3.3	4.5	0.596	2.5
					Weighted Average			11.0	0.353	
					Total for Zone Accepting Fluid					20.88

Injection Model and Calculations (Well as Currently Completed)

Summary of Calculations of Reservoir Areas Affected by Injection	
Net area in ½ mile radius in square feet	21,895,644 ft ²
Effective porosity of injection zone in feet	
Corrected for residual water = 0.353	20.88 ft
Available volume in ½ mile radius in cubic feet	457,181,050 ft ³
Volume injected per day in cubic feet/day (max. allowable) (in barrels per day)	19,962 ft ³ /day (3555 bbl/day)
Volume injected per year in cubic feet/year	7,291,009 ft ³ /year
Duration to fill ½ mile radius in years	62.7 years
Volume injected in 30 years in cubic feet (max. allowable)	218,730,272 ft ³
Percentage of available volume in ½ mile radius	48%
Area consumed in square feet (volume/effective porosity) (in acres)	10,475,588 ft ² (240.5 acres)
Radius of area in feet (assuming cylindrical distribution) (in miles)	1,826 ft (0.35 miles)

Map of Impacted Reservoir After 30 Years of Injection

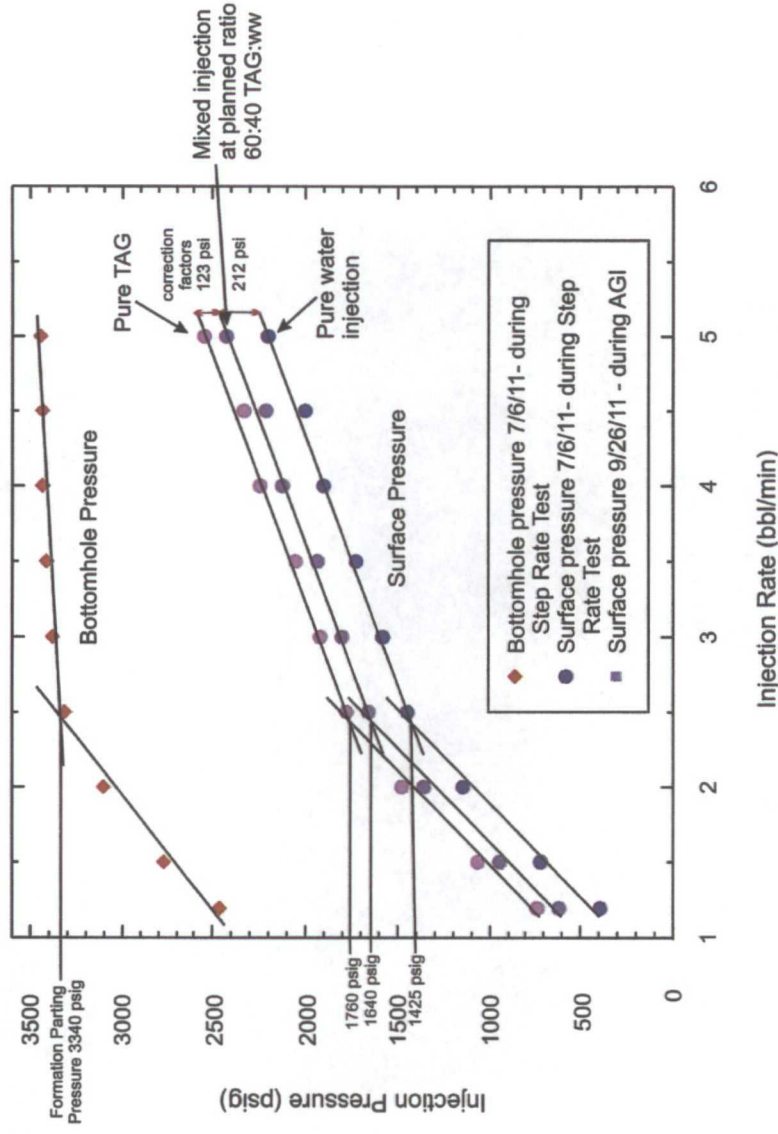


Requested Increase in Maximum Operating Pressure

- ▷ Current MAOP - 1300 psig
 - Based on mixed injection ~60 Vol% TAG and 40 Vol% wastewater
- ▷ Using SRT results This mixture works out to ~1640 psig based on SRT
- ▷ As mixture changes, so does SG of injection fluid and resultant hydrostatic head
 - Higher percentage TAG results in lower SG and greater injection pressure required to result in same bottomhole pressure
- ▷ Request approved MAOP based on mixture with safety factor built in based on OCD-witnessed Step Rate Test
 - For 60:40 TAG:wastewater mixture and greater TAG ($SG_{if} \sim 0.83-0.89$), request MAOP of 1600 psig

Step-Rate Test Results and MAOP Using Average TAG/Water Injection Mixtures

- ▶ Surface pressure curves can be corrected for different SG_{if}
- ▶ Request MAOP increase to:
 - 1600 psig for planned ratio (60:40)



Correction factors:

Pure TAG: 335 psig $SG_{if} = 0.83$

60:40 TAG:ww: 212 psig $SG_{if} = 0.89$

Pure ww: 0 psig $SG_{if} = 1.01$

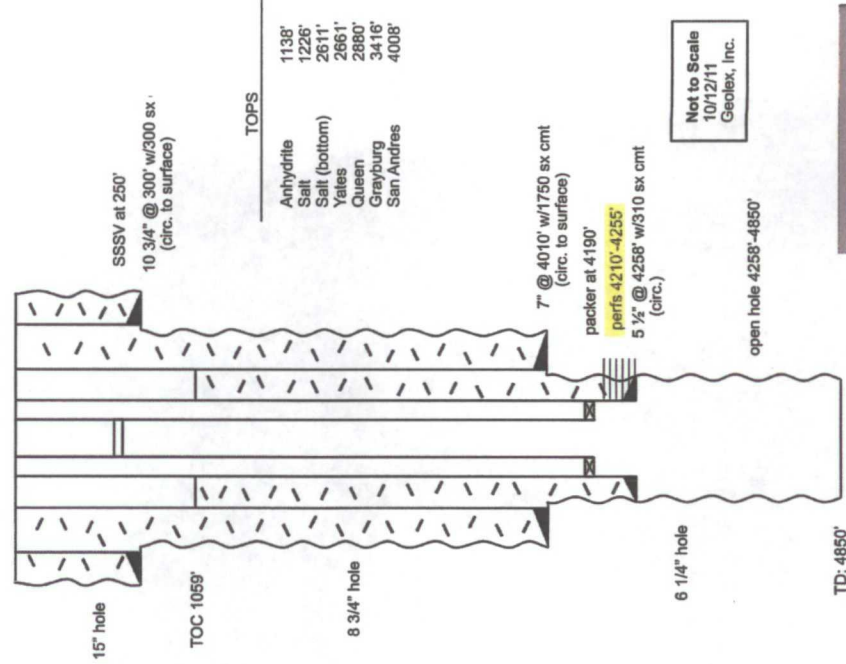
Requested Modification to Approved Injection Interval

- ▷ Currently approved 4250-4850 feet
- ▷ Reservoir tests indicate only limited injection below 4550 feet
- ▷ Openhole well logs and previous injection performance indicate high injectivity in 4010-4550 feet interval
- ▷ Request approval to perforate casing below packer to increase total thickness of injection interval

Requested Modification to Approved Injection Interval

- ▶ Request approval to perforate casing from 4210 feet (20 feet below packer) to 4258 feet (bottom of casing)
- ▶ This increase:
 - Leaves 200 foot buffer zone between injection zone and base of Grayburg (~4008 feet)
 - Further reduces area of impact to radius of 0.32 miles

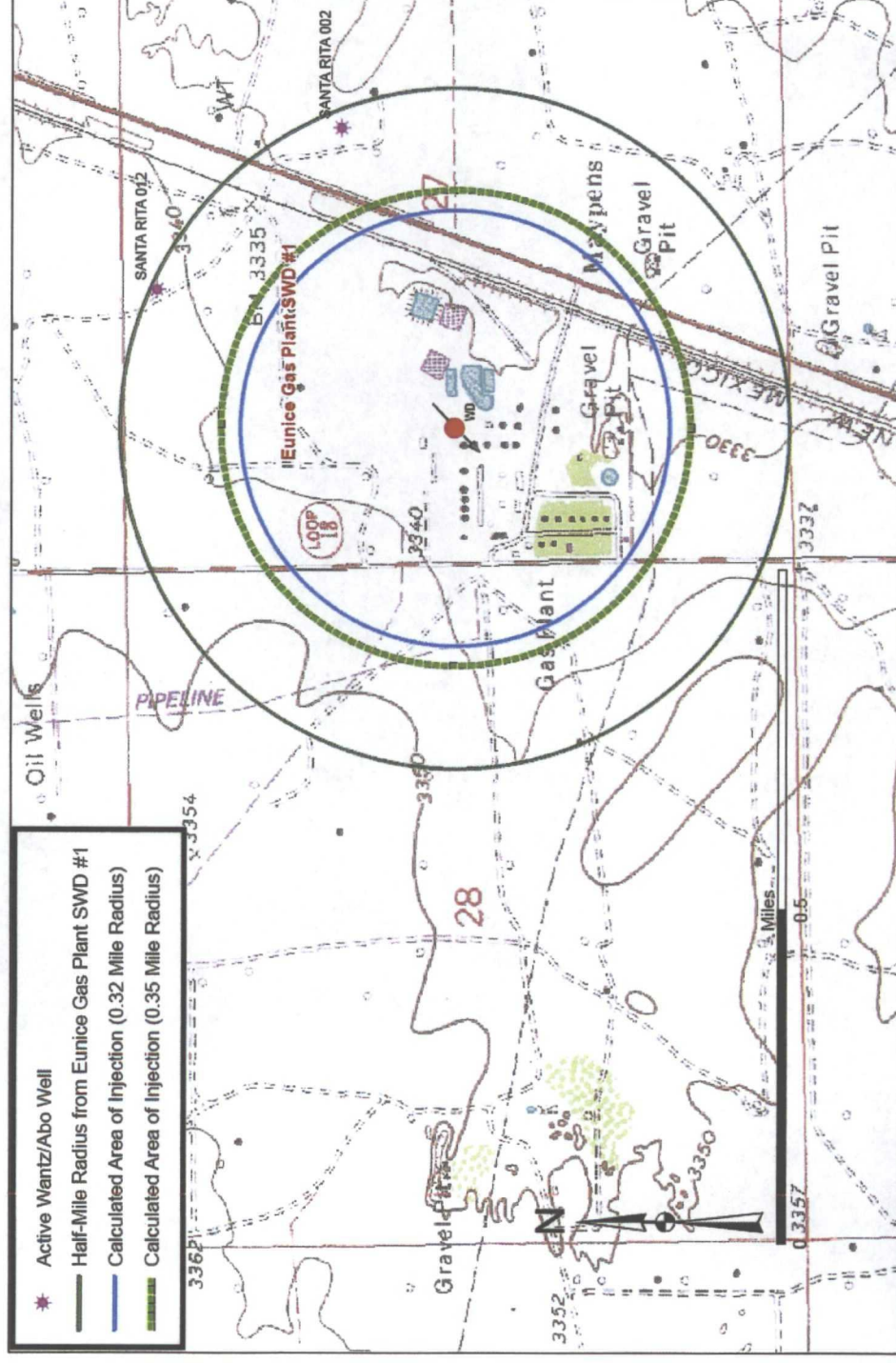
WELL NAME: Eunice Gas Plant SWD #1
 LOCATION: 2580' FSL & 1200 FWL Unit L Sec 27 T22S R37E
 GL: 3345' ZERO: KB:
 SPUD DATE: 10/26/61 RECOMPLETION DATE: 6/13/11
 COMMENTS: API #30-025-21497 PLUG DATE:



Injection Model and Calculations (Including Additional Injection Interval)

Summary of Calculations of Reservoir Areas Affected by Injection	
Net area in ½ mile radius, in square feet	21,895,644 ft ²
Effective porosity of injection zone in feet	
Corrected for residual water = 0.353	24.31 ft
Available volume in ½ mile radius in cubic feet	532,217,419 ft ³
Volume injected per day in cubic feet/day (max. allowable) (in barrels per day)	19,962 ft ³ /day (3555 bbl/day)
Volume injected per year in cubic feet/year	7,291,009 ft ³ /year
Duration to fill ½ mile radius in years	73.0 years
Volume injected in 30 years in cubic feet (max. allowable)	218,730,272 ft ³
Percentage of available volume in ½ mile radius	41%
Area consumed in square feet (volume/effective porosity) (in acres)	8,998,654 ft ² (206.6 acres)
Radius of area in feet (assuming cylindrical distribution) (in miles)	1,692 ft (0.32 miles)

Map of Impacted Reservoir After 30 Years of Injection for Proposed Interval



Targa's Request for Modification of NMOCC Order

- ▶ Authorize injection into Eunice Gas Plant SWD #1 for a 30-year lifespan
- ▶ Increase the MAOP at the Eunice Gas Plant SWD #1 using different values for different injection mixtures
 - MAOP of 1750 psig for pure TAG injection
 - MAOP of 1630 psig for mixtures with more TAG than 60:40 TAG:wastewater
 - MAOP of 1410 psig for mixtures with less TAG than 60:40 TAG:wastewater (including pure wastewater)
- ▶ Authorize perforation of interval 4210-4258 feet and authorize injection into that interval