

Means San Andres Unit
Means Field
Hydrocarbon Gas Production Forecast
June, 2003

Background

The majority of the Means San Andres Unit is currently producing under CO2 flood with the field's edge under water flood. Most of the produced hydrocarbon gas is re-injected along with produced and purchased CO2. There is no processing of the produced gas. Based on the success at Salt Creek, the Gas Plant Group has evaluated an option to build a processing plant at Means and decided it did not meet our expectations. Salt Creek oil is much lighter and has a higher associated gas. They are now investigating obtaining a third party to process the produced gas and have asked for a forecast of total gas production and a forecast of its composition.

Observations and Assumptions

The amount of hydrocarbon gas to be recovered is the sum of the associated gas produced since Means began recycling gas (times a recovery factor) plus gas associated with future oil production.

Reservoir GOR	230	SCF/STB
Oil Produced since CO2 gas sales stopped (1-1-85)	85.27	MSTB
Gas bubble associated with recycling produced gas	19.6	GCF
Assumed recovery factor for gas	0.7	
Recoverable gas associated with recycled gas	13.7	GCF
Recoverable gas associated with future oil production	10.1	GCF
Total Gas available for processing	23.8	GCF

The composition of the hydrocarbon content has not changed significantly from pre-CO2 flood gas composition. Note that the simulation of CO2 purchases by adding CO2 gives a combined composition very similar to the current composition.

	1980	Additional		Current
	Sep Gas	CO2	Combined	11/26/01
Hydrogen Sulfide	11.86		2.16	2.40
Nitrogen	0.81		0.15	1.17
Carbon Dioxide	3.42	448.00	82.38	82.38
Methane	41.21		7.52	6.20
Ethane	23.62		4.31	4.90
Propane	10.06		1.84	1.25
Isobutane	2.31		0.42	0.39
Butane	3.53		0.64	0.57
Isopentane	1.51		0.28	0.33
pentane	0.58		0.11	0.11
Hexane+	0.63		0.11	0.30
Heptanes +	0.46		0.08	
	100.00	448.00	100.00	100.00

Recent changes to CO2 purchases and injection have resulted in a significant drop in total gas production from 56 Mcfd to 40 Mcfd.

An injector profile evaluation and modification program has begun and is showing some signs of success.

Because lower gas production is resulting in excess compression capacity, expansion of the CO2 flood into other areas of the field is under evaluation

We are also considering increasing gas lift operations to make use of the available compression

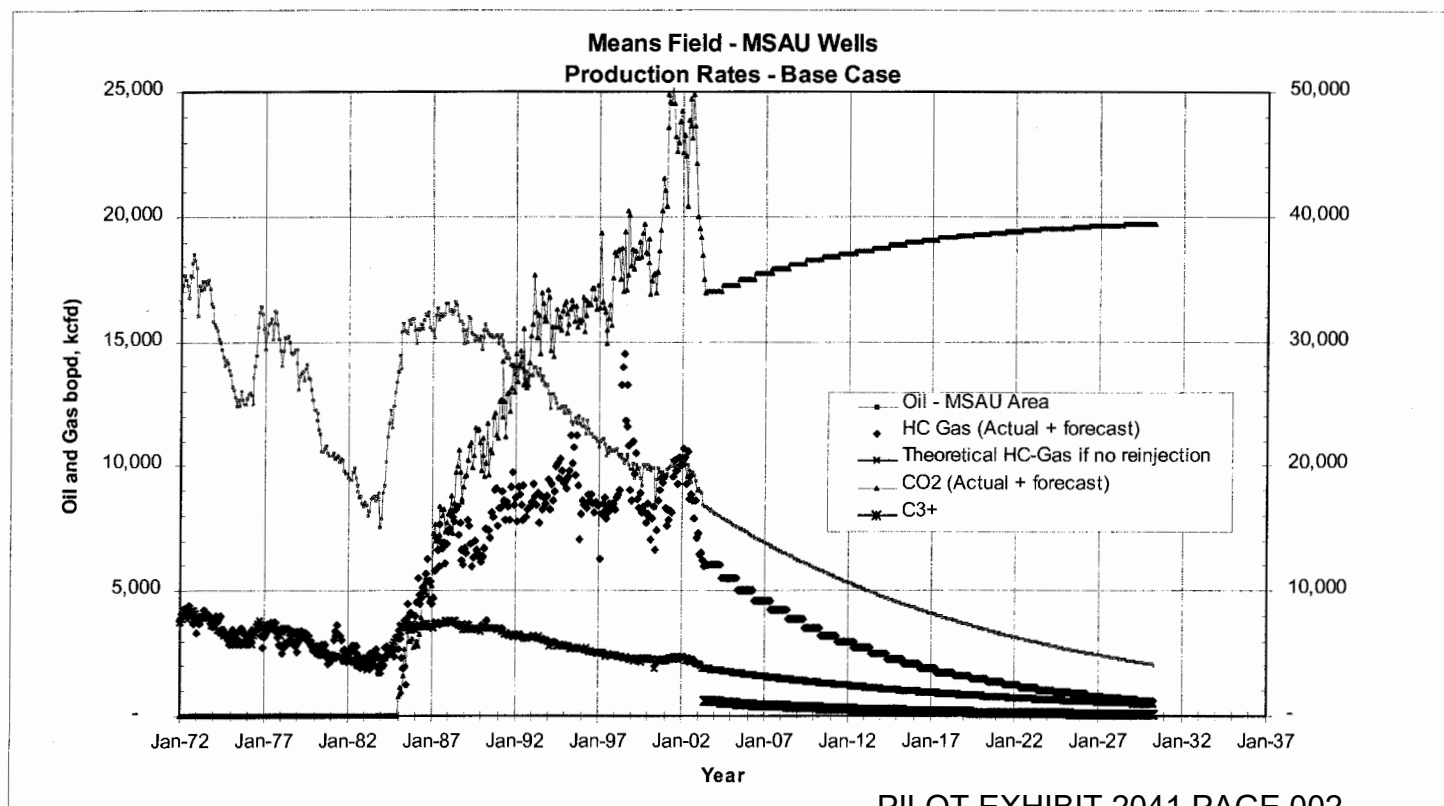
To address the degree of uncertainty related to these recent field operational changes, three gas production/injection scenarios have been developed.

<u>Case</u>	<u>Total Gas Production (Mcf/d)</u>	<u>Gas Injection (Mcf/d)</u>	<u>Comment</u>
Minimum	35	40	Lower production, poor pro-mod results
Base	40	45	Maintain Production, average pro-mod results
High	50	55	Increased production, better pro-mod results

In all three scenarios, gas shrinkage due to processing is replaced by purchasing additional CO2.

Forecasts

The following graph shows the base case historical and forecasted production including a C3+ component forecast. The associated Excel workbook can be used to run additional sensitivities and to adjust the fractional component forecast.



The following graph shows the C3+ composition forecast for the three sensitivities. It should be noted that a 2/26/88 memo suggested miscibility would be maintained if the C1/C3+ ratio stays below 2.5. Currently at 2.1 it would go above 2.5 if C3 or C4 is removed. There was also a comment that miscibility should be independent of CO2 quality but Means slim tube experiments only went down to 89.7% CO2 and current injection is 85% CO2.

