

Digital Oil



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Neglected

There is a Lot Underneath

California Crude

- **Heavy crude and viscous fluids**
- **Inflow problems**
- **Pump problems**

Remedies

- Well Work
 - Exiting Wells
 - New and Re-drills

Short Term Gains

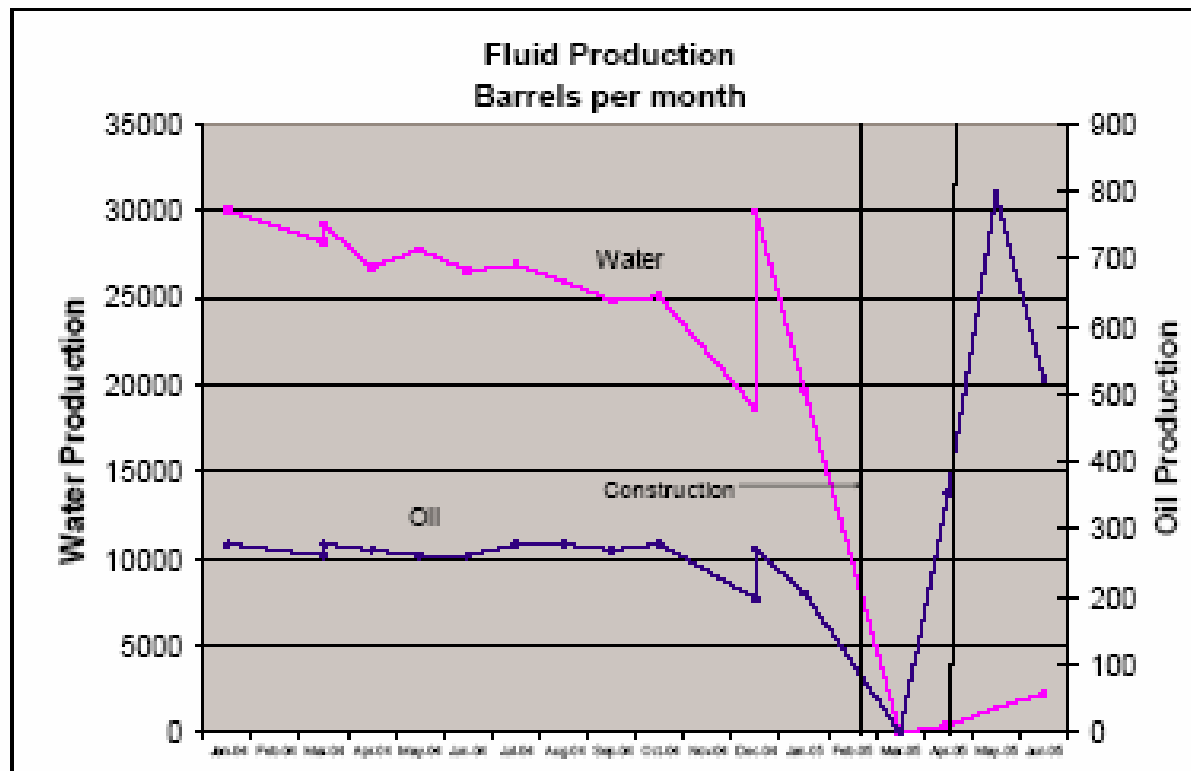
- Reservoir Work

Long Term Projects

Success Stories

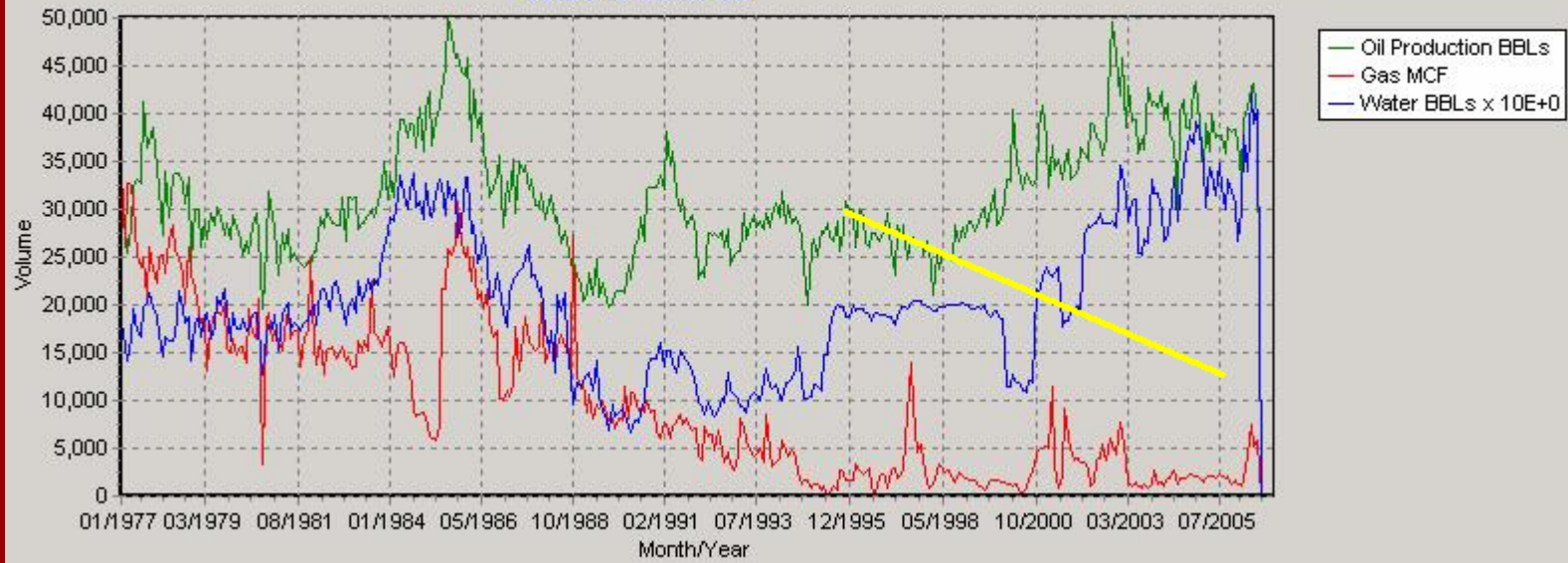
- Workovers
- New Drilling/Completion Using Better Technologies
- Reservoir Characterization and Modeling
- New Monitoring Technologies

**Figure 4-Reduction of Water Production after Remedial
SPE 100651 Work**



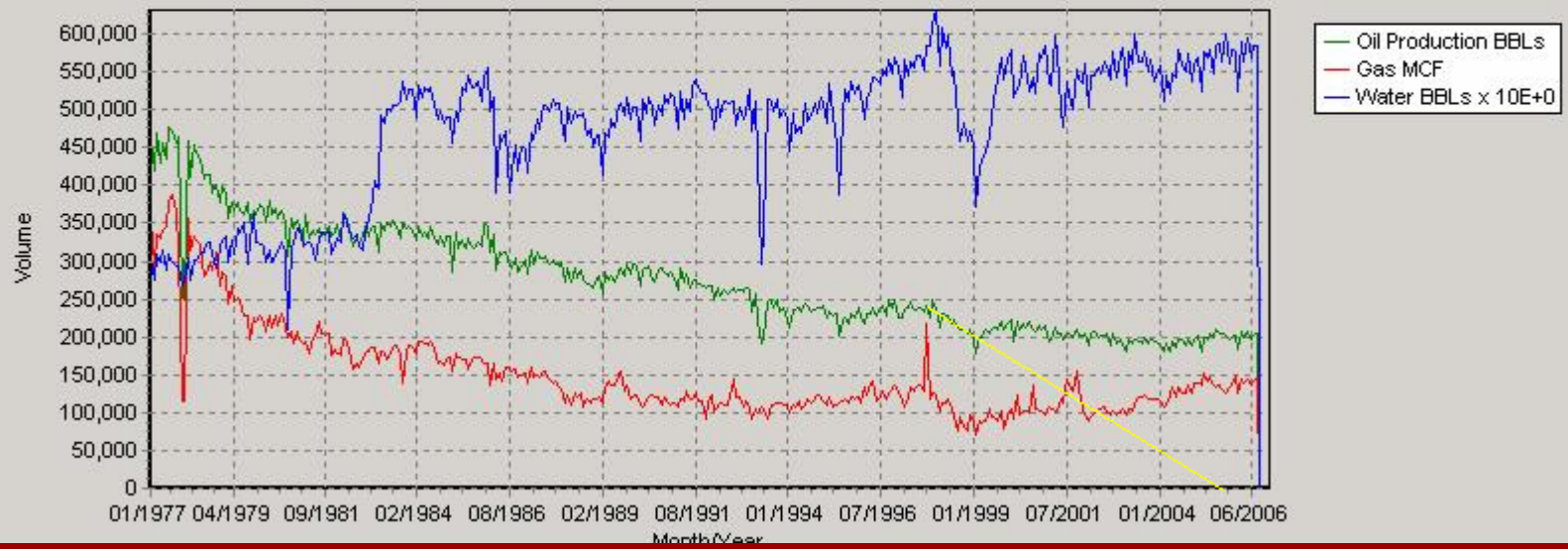
Holmes Western Oil Corp.

Volume Vs. Month/Year



Breitburn Energy Co. LP

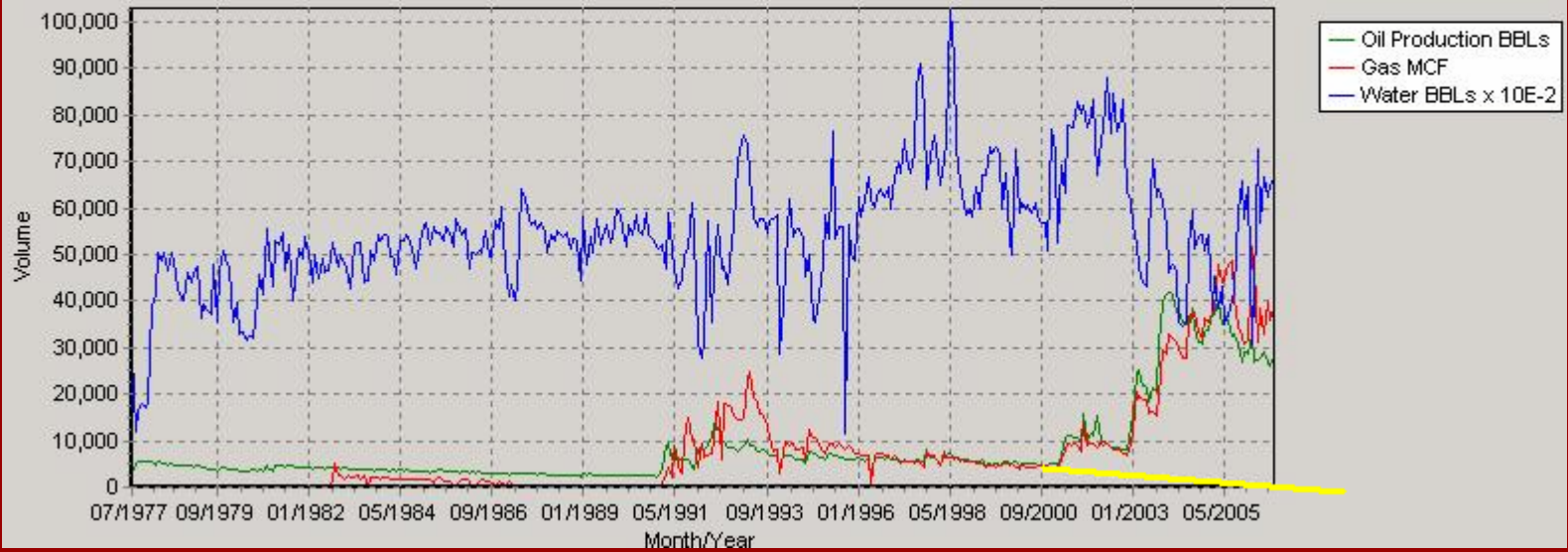
Volume Vs. Month/Year



DCOR, LLC

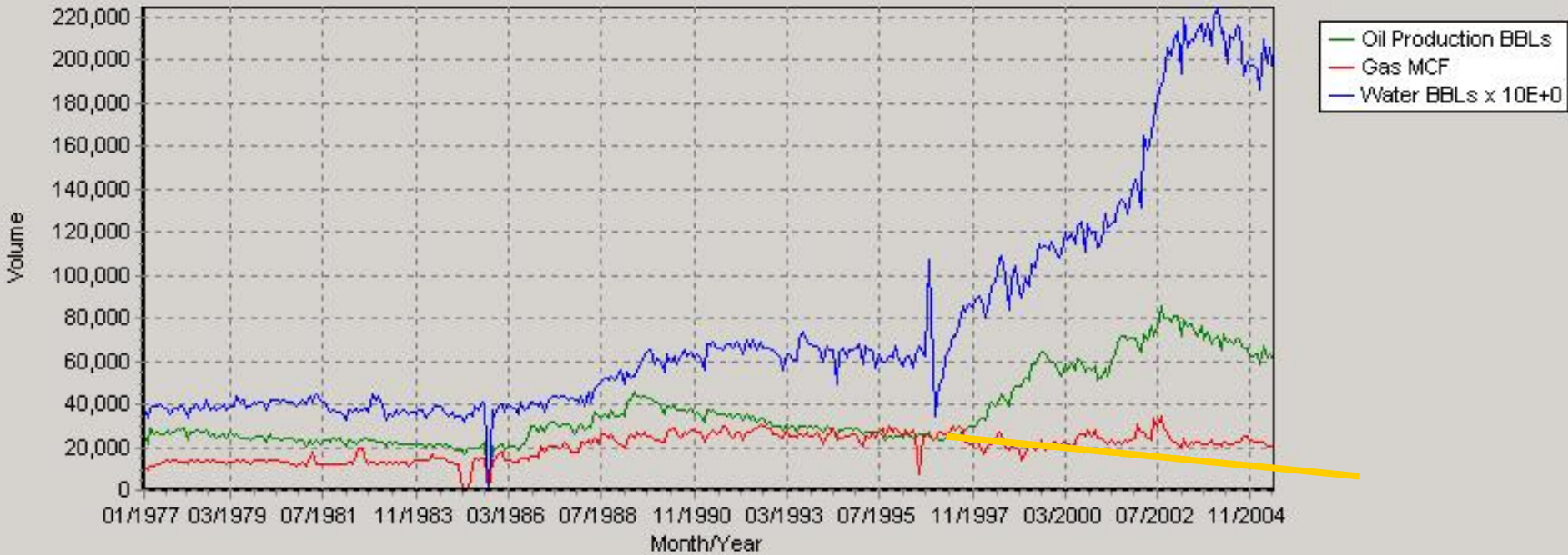
Cascade

Volume Vs. Month/Year



Montebello

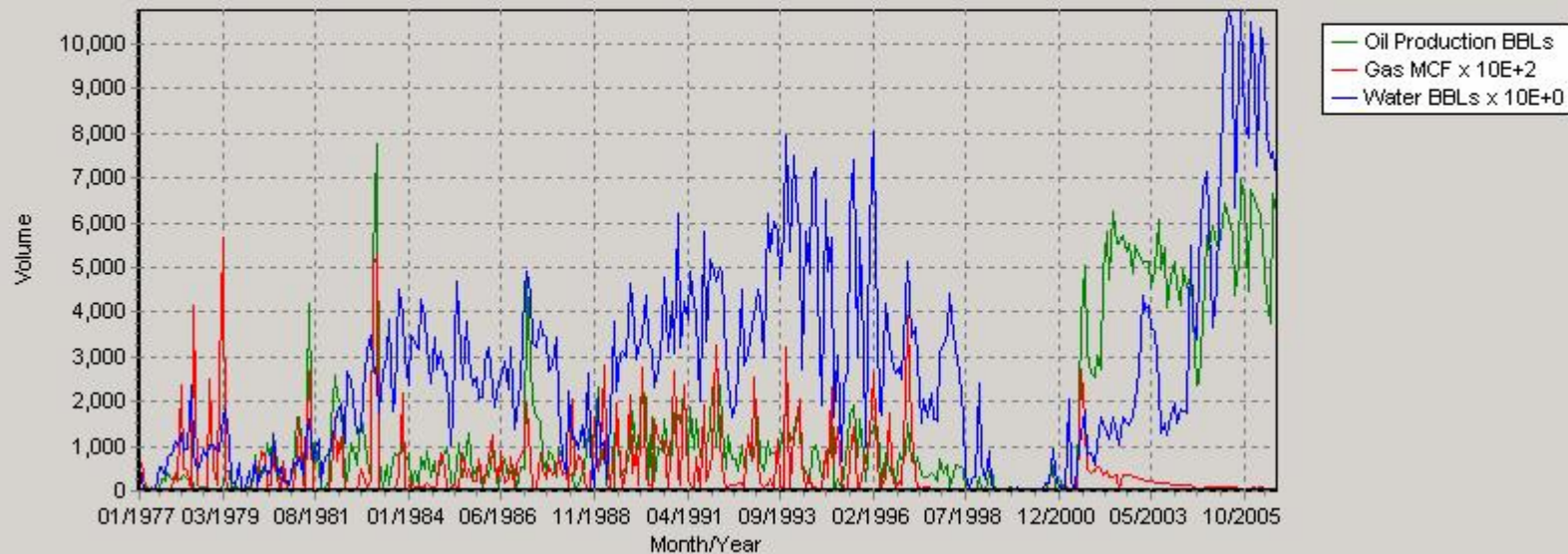
Volume Vs. Month/Year



Southern Calif. Gas Co.

Montebello

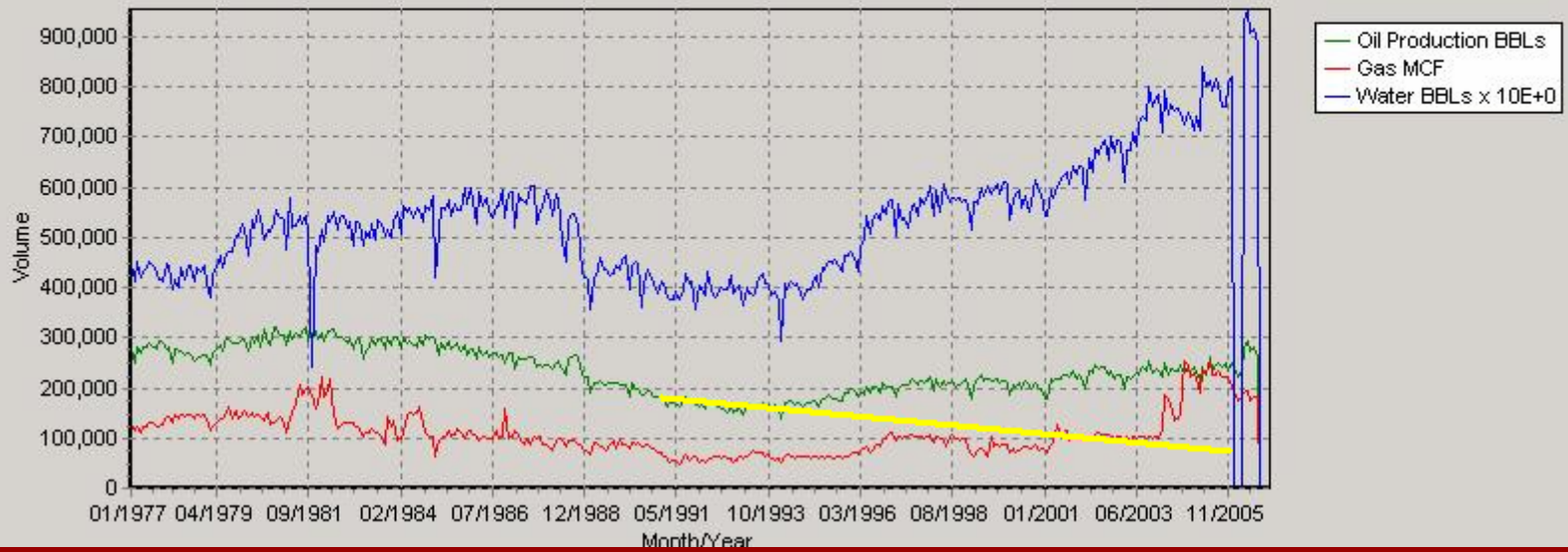
Volume Vs. Month/Year



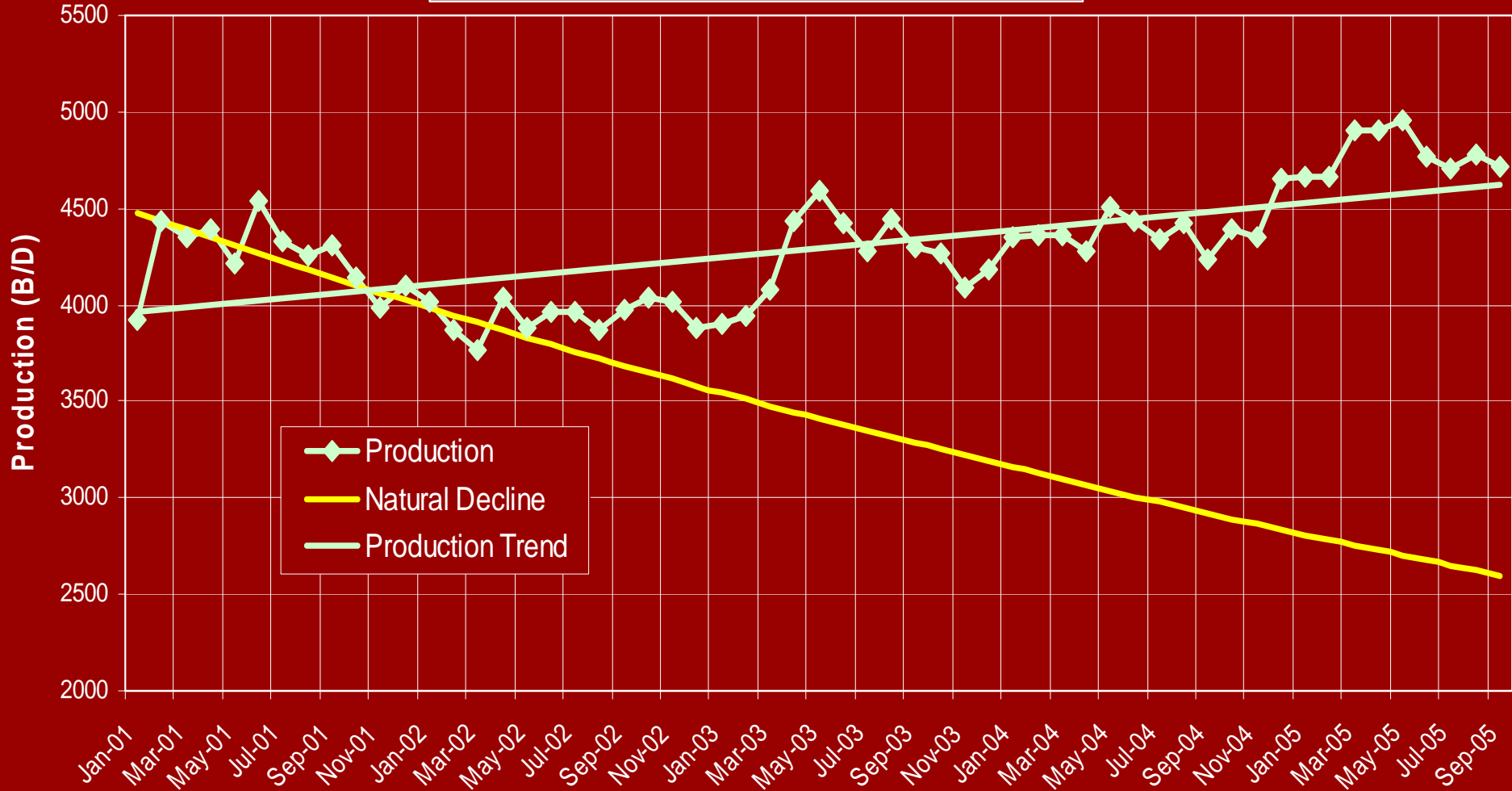
Plains Expl. & Prod. Co.

Inglewood

Volume Vs. Month/Year

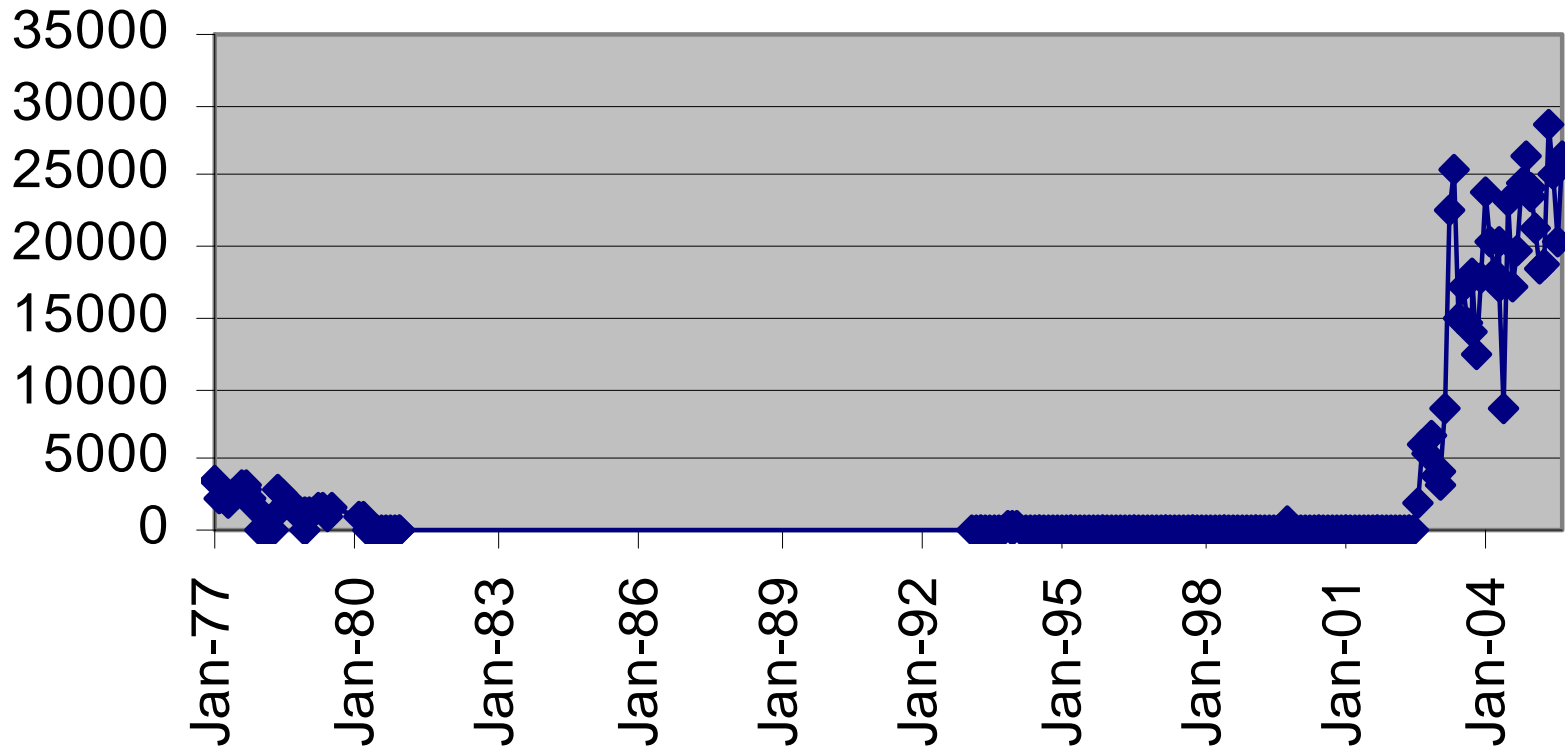


Average Daily Production for the last 57 Months
January 2001 through September 2005

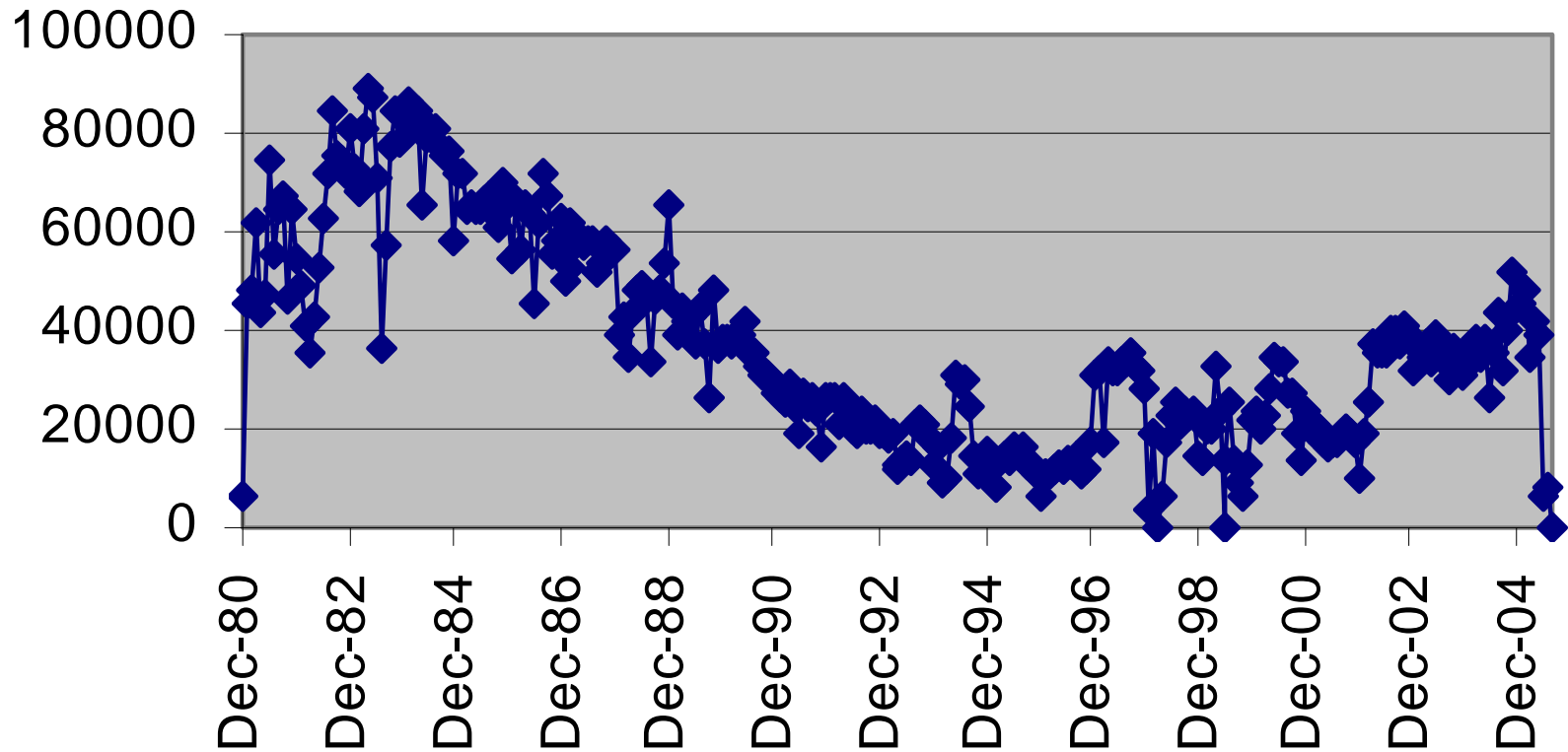


Production over the 57 months is trending up at an average of 3.6% per year.

OILPROD South Ellwood 3242-7



OILPROD South Ellwood 3242-18



Decline:

- Decrease in rate of Production with time

Depletion:

- Decrease in the amount of hydrocarbon

Possibilities

Field	Cum, MMMbbl	Reported Reserves,MMMbbl	STOIP,MMMbb ls	P50,MMMbb ls
Hunt Beach	1.1	.047	3.4	1.0
Long Beach	0.9	.011	2.7	1.0
Inglewood	.378	.051	1.14	0.3
Beverly Hills	.142	.016	.30	0.1
Wilmington	2.6	.380	7.4	1.0

Workover Roadmap

- **Causes of Low Productivity**
- **Types of damage**
- **Identify Opportunities**
- **Consult on Remedies**

Problems-Well Workovers

- Excessive water production
- Formation Damage
- Emulsion Block
- Low Formation Pressure

Damage Around The Well

- Organic damage
- Emulsion damage
- Scale damage

Emulsion Damage

Occurrence

- After pump changes
- Circulation
- Washbacks
- Jet washes
- Steam cycles

Fines

- **Stabilize emulsions**
- prevent coalescence of water droplets
- decrease surface tension

Hot Watering Enhancement

Increase wellbore temp

- Short lived response
- Prod. decline acute and rapid
- Response may be less than before

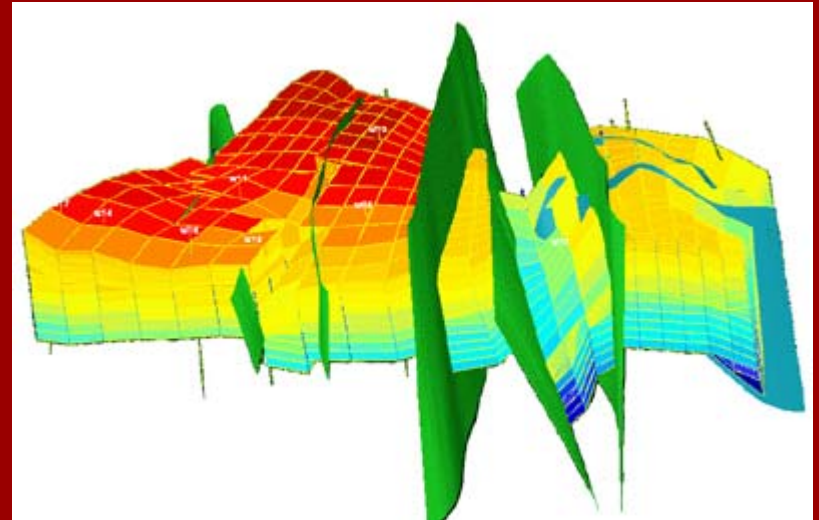
Reservoir Solutions

- **Drilling and Re-entry**
- **Behind Pipe Reserves**
- **Imaging**



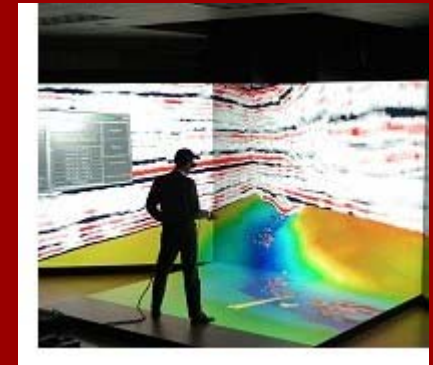
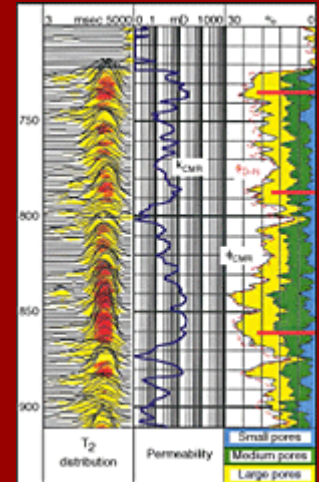
Unknowns

- Pore Volume
- Oil Saturation
- Aquifer Strength
- Compartments



Technologies

- New Cased Hole Logs
- Horizontal Drilling
- Side track-Under balanced Drilling
- Wellbore Cleanup
- Thermal Methods
- Digital Oil



The Marginal Field Challenge

- Effective & Efficient Well Utilization
- Reservoir Characterization: “Stranded Barrel”
- Reservoir Surveillance
- Data Management
- Pressure Maintenance/EOR
- Analogy

Points To Remember

- Need Integrated Approach customized for each field
- Well bore Cleanup can stimulate and accelerate but will not affect residual oil
- Drilling more wells is not a solution
- Focus on reducing residual saturation

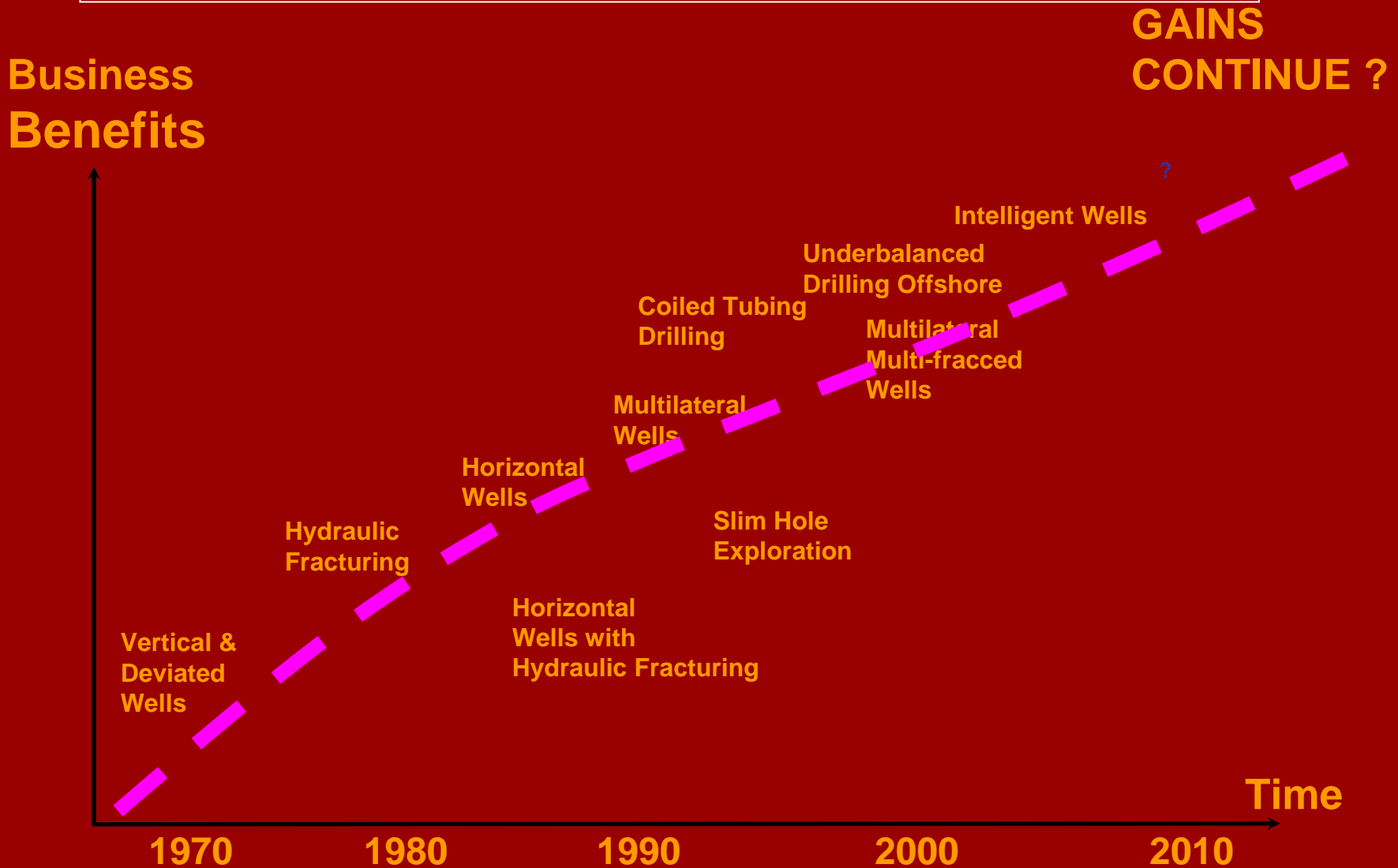
Technologies

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Digital Solutions

- Data acquisition and analysis
- Integration of geological, seismic, reservoir, and production data to enable detection and recovery from sweet spots
- Managing uncertainty through effective brownfield review, planning and development

New Well Technology S Curve Evolution



Elements

- Monitoring
- Data Mining
- Decision Making
- Remote Control-
 - Reducing re-entry Cost

Marginal Oilfields

Hidden Giants in Existing Fields

- Little Room for Errors
- Risks of Operating With Limited Data

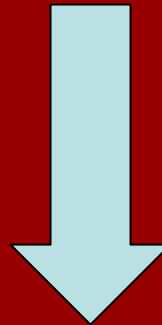
Plenty oil Out there





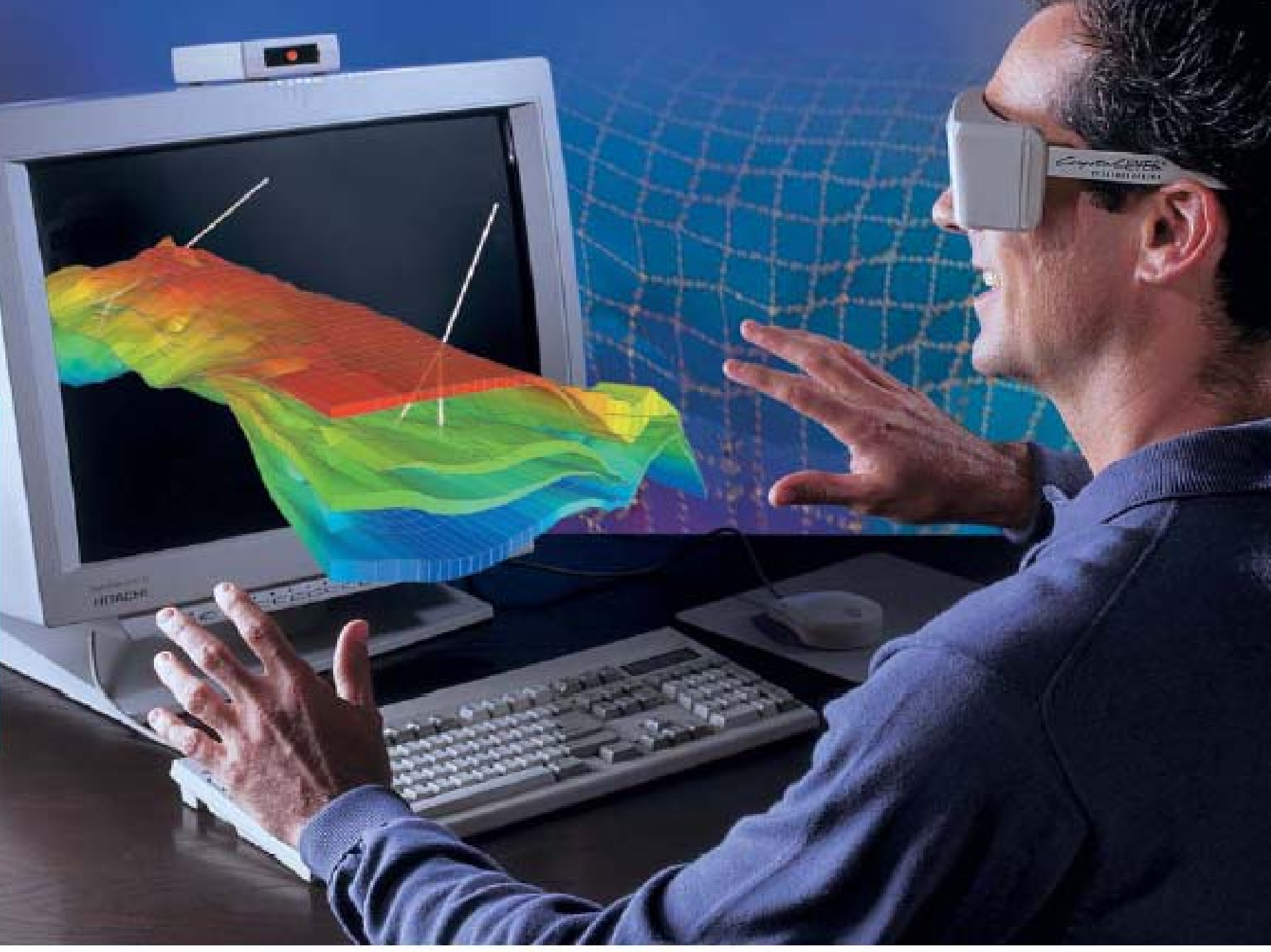
~35% Produced

Target 25-30%



Original Oil In Place?







Homeland Security