Agenda

• Jurisdiction over the Gulf of Mexico
• Shelf and Deepwater Development
• Oil Production and Top Producers
• Crude Types and Quality Trends
• Quality Control and Quality Concerns
In 1983, President Reagan proclaimed the sovereign rights and jurisdiction of the United States over submerged lands and seas adjacent to the United States within the Exclusive Economic Zone (EEZ) as recognized by international law.

The EEZ extends a distance of 200 nm from the baseline from which the breadth of the territorial sea is measured.

The EEZ 200 nm limit, however, does not define the outer limit of the OCS under the OCS Lands Act and the Submerged Lands Act, and may be better considered in that context as a jurisdictional minimum, except where constrained by the jurisdictional reaches of adjacent coastal nations.
Bureau of Ocean Energy Management Regions

Alaska OCS

BOEM Alaska Region Office
3801 Centerpoint Dr Ste 500
Anchorage, AK 99503

Pacific OCS

BOEM Pacific Region Office
760 Paseo Camarillo
Camarillo, CA 93010

Atlantic OCS

BOEM Gulf of Mexico Region Office
1201 Elmwood Park Blvd
New Orleans, LA 70123

200 nm
Outer Continental Shelf (OCS)

The OCS is defined as all submerged lands, subsoil, and seabed lying between the seaward extent of the state’s jurisdiction and the seaward extent of the Federal jurisdiction as defined in the Submerged Lands Act. For most states, Federal jurisdiction lies 3 nautical miles seaward of state jurisdiction. However, Texas and Florida and Louisiana are special:

- Texas and the Gulf Coast of Florida is 3 marine leagues (about 9 nm) seaward
- Louisiana is 3 imperial nm seaward (1 imperial nm is 6080 ft)
- Several states have had their seaward boundary “fixed” (permanently immobilized) by the Supreme Court, and these fixed boundaries are not affected by a normally ambulating coastline.

Note: A nautical mile = 6076 ft or 1.15 statute miles (land measured mile).
State Jurisdiction

2017–2022 Oil and Gas Leasing Proposed Final Program Area for the Gulf of Mexico Region

- Planning Area Boundary
- Flower Garden Banks National Marine Sanctuary
- Presidential Withdrawal Areas
- Proposed Final Program Area
- Congressional Moratorium (Expires June 30, 2022)

The maritime boundaries and limits shown here are for initial planning purposes only and do not necessarily reflect the full extent of U.S. sovereign rights under international and domestic law.
Shelf & Deepwater Developments
Deepwater Northern Gulf of Mexico Oil Trends

Source: Overview of the Northern Deepwater Gulf of Mexico by Dennis Coyne 09/04/2016
Perspective on Seafloor Topography
Seismic Data Advanced in 1990’s

Tahiti Representation

Source: Overview of the Northern Deepwater Gulf of Mexico by Dennis Coyne 09/04/2016
Extent of Salt Canopy

Source: Overview of the Northern Deepwater Gulf of Mexico by Dennis Coyne 09/04/2016
Deepwater Development Systems

Bottom Supported and Vertically Moored Structures

- Fixed Platform (FP)
- Compliant Tower (CT)
- Tension Leg Platform (TLP)
- Mini-Tension Leg Platform (Mini-TLP)

Source: BSEE – Deepwater Development Systems in the Gulf of Mexico Basic Options
Deepwater Development Systems

Floating Production and Subsea Systems

- SPAR Platform (SP)
- Floating Production Systems (FPS)
- Shuttle Tanker
- Floating Production, Storage & Offloading (FPSO)
- Subsea System (SS)
Drilling Deep in the Gulf of Mexico

“It’s not a place for the timid,” said Paul K. Siegele, Vice President for deepwater exploration at Chevron. “It’s a place where a lot of people have lost their shirts.” - NYT 2006

Petronius 1998 – 1 yr delay

Thunder Horse – left listing after Hurricane Dennis in 2005; delayed till 2008.

Deepwater Horizon Blowout 2010

Big Foot TLP Tendons - 2015
Oil Production & Top Producers
U.S. crude oil production in 2015 was the highest since 1972, but has since declined.
Expected decrease in Lower 48 oil production is partially offset by rising GOM output

Monthly U.S. crude oil production (2010-17)

Note: Includes lease condensate.
Annual Crude Production by State or Area

Source: U.S. Energy Information Administration, *Petroleum Supply Annual*
Shelf and Deepwater Production History

Source: Overview of the Northern Deepwater Gulf of Mexico by Dennis Coyne 09/04/2016
Top Crude Producers in 2016

<table>
<thead>
<tr>
<th>Operator</th>
<th>Crude Oil (BBLs)</th>
<th>Condensate (BBLs)</th>
<th>Total Oil (BBLs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Shell Offshore Inc.</td>
<td>96,544,206</td>
<td>5,646,513</td>
<td>102,190,719</td>
</tr>
<tr>
<td>2. BP Exploration &amp; Production Inc.</td>
<td>101,687,826</td>
<td>57,380</td>
<td>101,745,206</td>
</tr>
<tr>
<td>3. Anadarko Petroleum Corporation</td>
<td>58,209,694</td>
<td>527,597</td>
<td>58,737,291</td>
</tr>
<tr>
<td>4. Chevron U.S.A. Inc.</td>
<td>46,967,292</td>
<td>1,542,126</td>
<td>48,509,418</td>
</tr>
<tr>
<td>5. LLOG Exploration Offshore, L.L.C.</td>
<td>33,931,274</td>
<td>1,879,570</td>
<td>35,810,844</td>
</tr>
<tr>
<td>6. BHP Billiton Petroleum (GOM) Inc.</td>
<td>27,913,668</td>
<td>0</td>
<td>27,913,668</td>
</tr>
<tr>
<td>7. Noble Energy, Inc.</td>
<td>22,005,223</td>
<td>428</td>
<td>22,005,651</td>
</tr>
<tr>
<td>8. Fieldwood Energy LLC</td>
<td>14,671,018</td>
<td>3,390,741</td>
<td>18,061,759</td>
</tr>
<tr>
<td>9. Freeport-McMoRan Oil &amp; Gas LLC</td>
<td>17,354,465</td>
<td>25,872</td>
<td>17,380,337</td>
</tr>
<tr>
<td>10. Hess Corporation</td>
<td>5,221,858</td>
<td>10,516,075</td>
<td>15,737,933</td>
</tr>
<tr>
<td>11. Energy XXI GOM, LLC</td>
<td>9,975,700</td>
<td>1,338,850</td>
<td>11,314,550</td>
</tr>
<tr>
<td>12. Union Oil Company of California</td>
<td>10,259,862</td>
<td>12,575</td>
<td>10,272,437</td>
</tr>
<tr>
<td>13. Arena Offshore, LP</td>
<td>8,283,489</td>
<td>434,997</td>
<td>8,718,486</td>
</tr>
<tr>
<td>15. Exxon Mobil Corporation</td>
<td>7,296,592</td>
<td>687,105</td>
<td>7,983,697</td>
</tr>
<tr>
<td>16. Eni Petroleum Co. Inc.</td>
<td>7,410,672</td>
<td>225,673</td>
<td>7,636,345</td>
</tr>
<tr>
<td>17. Shell Gulf of Mexico Inc.</td>
<td>6,321,151</td>
<td>0</td>
<td>6,321,151</td>
</tr>
<tr>
<td>18. Murphy Exploration &amp; Production Co</td>
<td>5,886,693</td>
<td>2,894</td>
<td>5,889,587</td>
</tr>
<tr>
<td>19. Walter Oil &amp; Gas Corporation</td>
<td>4,109,250</td>
<td>1,288,620</td>
<td>5,397,870</td>
</tr>
<tr>
<td>21. Petrobras America Inc.</td>
<td>4,694,838</td>
<td>148,533</td>
<td>4,843,371</td>
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<tr>
<td>22. W &amp; T Offshore, Inc.</td>
<td>3,067,074</td>
<td>1,594,394</td>
<td>4,661,468</td>
</tr>
<tr>
<td>23. EnVen Energy Ventures, LLC</td>
<td>3,068,043</td>
<td>1,067,107</td>
<td>4,135,150</td>
</tr>
<tr>
<td>24. GOM Shelf LLC</td>
<td>3,559,742</td>
<td>277,118</td>
<td>3,836,860</td>
</tr>
<tr>
<td>25. Deep Gulf Energy II, LLC</td>
<td>2,647,895</td>
<td>0</td>
<td>2,647,895</td>
</tr>
</tbody>
</table>

Source: BOEM – Ranking Operator by Oil
## Top 6 Deepwater Fields - Cumulative Oil Production

### Map
- **SEGC** = Southeast Green Canyon Miocene subsalt
- **PFB** = Perdido Fold Belt (trend extends into Mexican waters)
- **Outliers** – single fields or discoveries that don't appear to be part of a trend

### Table

<table>
<thead>
<tr>
<th>Field</th>
<th>Cumulative oil production through early 2016</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mars</td>
<td>684</td>
<td>Mars/Ursa basin</td>
</tr>
<tr>
<td>Atlantis</td>
<td>255</td>
<td>Southeast Green Canyon</td>
</tr>
<tr>
<td>Auger</td>
<td>252</td>
<td>Basin Play</td>
</tr>
<tr>
<td>Ursa</td>
<td>230</td>
<td>Mars/Ursa basin</td>
</tr>
<tr>
<td>Shenzi/Ghengis Khan</td>
<td>224</td>
<td>Southeast Green Canyon</td>
</tr>
<tr>
<td>Tahiti</td>
<td>201</td>
<td>Southeast Green Canyon</td>
</tr>
</tbody>
</table>

Source: Overview of the Northern Deepwater Gulf of Mexico by Dennis Coyne 09/04/2016
Crude Type & Quality Trends
### Offshore Crude Gathering Systems

<table>
<thead>
<tr>
<th>System Name</th>
<th>Start-up</th>
<th>Crude Type</th>
<th>MBPD</th>
</tr>
</thead>
<tbody>
<tr>
<td>South Pass/West Delta/Main Pass/Grand Isle</td>
<td>1960's</td>
<td>Heavy Louisiana Sweet</td>
<td>250</td>
</tr>
<tr>
<td>Ship Shoal Pipeline System</td>
<td>1973</td>
<td>Light Louisiana Sweet</td>
<td>50</td>
</tr>
<tr>
<td>Eugene Island Pipeline System (EIPS)</td>
<td>1976</td>
<td>Eugene Island</td>
<td>65</td>
</tr>
<tr>
<td>High Island Pipeline System</td>
<td>1978</td>
<td>HIPS</td>
<td>10</td>
</tr>
<tr>
<td>Auger Pipeline System</td>
<td>1994</td>
<td>Bonito Sour</td>
<td>100</td>
</tr>
<tr>
<td>Mars Oil Pipeline System (Mars)</td>
<td>1996</td>
<td>Mars Blend</td>
<td>400</td>
</tr>
<tr>
<td>Poseidon Oil Pipeline System (Poseidon)</td>
<td>1998</td>
<td>Poseidon</td>
<td>225</td>
</tr>
<tr>
<td>Hoover Offshore Oil Pipeline System (HOOPS)</td>
<td>2000</td>
<td>HOOPS</td>
<td>100</td>
</tr>
<tr>
<td>Cameron Highway Oil Pipeline System (CHOPS)</td>
<td>2004</td>
<td>Southern Green Canyon</td>
<td>250</td>
</tr>
<tr>
<td>Endymion</td>
<td>2008</td>
<td>Thunder Horse Blend</td>
<td>150</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1600</td>
</tr>
</tbody>
</table>
## Crude Segregations – Light, Intermediate and Sour

<table>
<thead>
<tr>
<th>Grade</th>
<th>Market</th>
<th>MBPD</th>
<th>Total</th>
<th>% of Total</th>
<th>API</th>
<th>%S</th>
<th>V</th>
<th>Ni</th>
<th>TAN</th>
<th>Salt</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Sweet</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Less than 0.5% S</td>
<td>LLS St James</td>
<td>50</td>
<td></td>
<td>300</td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td>0.4</td>
<td>54</td>
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<td></td>
<td>HLS Empire</td>
<td>240</td>
<td></td>
<td></td>
<td>84%</td>
<td></td>
<td></td>
<td></td>
<td>0.4</td>
<td>75</td>
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<td></td>
<td>HIPS Texas City</td>
<td>10</td>
<td></td>
<td></td>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td>0.4</td>
<td>18</td>
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<tr>
<td><strong>Light Sour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than 0.5%S; Less than 1.5%S</td>
<td>Bonito St James</td>
<td>100</td>
<td></td>
<td>400</td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
<td>0.9</td>
<td>151</td>
</tr>
<tr>
<td></td>
<td>EIC St James</td>
<td>65</td>
<td></td>
<td></td>
<td>75%</td>
<td></td>
<td></td>
<td></td>
<td>0.6</td>
<td>70</td>
</tr>
<tr>
<td></td>
<td>THB LOOP</td>
<td>140</td>
<td></td>
<td></td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
<td>0.1</td>
<td>4</td>
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<tr>
<td></td>
<td>HOOPS Texas City</td>
<td>95</td>
<td></td>
<td></td>
<td>25%</td>
<td></td>
<td></td>
<td></td>
<td>0.9</td>
<td>3</td>
</tr>
<tr>
<td><strong>Medium Sour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Greater than 1.5% S</td>
<td>Mars Blend LOOP</td>
<td>425</td>
<td></td>
<td>900</td>
<td>55%</td>
<td></td>
<td></td>
<td></td>
<td>0.4</td>
<td>50</td>
</tr>
<tr>
<td></td>
<td>Poseidon Houma</td>
<td>225</td>
<td></td>
<td></td>
<td>55%</td>
<td></td>
<td></td>
<td></td>
<td>0.5</td>
<td>63</td>
</tr>
<tr>
<td></td>
<td>SGC TC / PA</td>
<td>250</td>
<td></td>
<td></td>
<td>35%</td>
<td></td>
<td></td>
<td></td>
<td>0.2</td>
<td>25</td>
</tr>
</tbody>
</table>
Project Development

Producer Priorities:

#1  Flow Assurance
#2  Netback Price/Price Stability – Optionality is Key!

Transporter Priorities:

#1  Volume Commitments
#2  D/S Connectivity, Reliability & Takeaway Capacity
Poseidon Oil Pipeline System
Quality Control & Quality Concerns
Important Points to Remember

Offshore Pipelines are Gathering Systems

– Flow lines contain water, oil & gas
– Production facilities will have excursions
– Additives are used to enhance production and flow

Pipelines Must Provide Open & Nondiscriminatory Access (OCSLA)

– Provide means to mitigate effects of commingling (i.e. quality bank)
– Landmark Auger Decision

Hub Platforms Enable Production to Achieve the Best Netback Price

– Stream switching is good for the Producer, but not so good for the Refiner
– Refiners will discount or shun streams with inconsistent quality
Crude Quality Concerns

Inherent Properties of Crude Oil:
- Water Content – production operations & pipeline slugs
- Salt Content
- Gas Content
- Total Acidity Number (TAN)
- Viscosity
- H₂S

Additive:
- Methanol – hydrate inhibitor
- Silicon – defoaming agent
- Drag Reducing Agents (DRA)
LHC Quality Assurance Standard

SHELL PIPELINE COMPANY LP

Liquid Hydrocarbon Quality Assurance Standard

September 2009

SHELL PIPELINE COMPANY LP AND OPERATED ENTITIES
Quality Limitations

The following liquid hydrocarbon property limitation apply to all liquid hydrocarbons to be transported by COMPANY on liquid hydrocarbon systems:

1. Reid Vapor Pressure (RVP):
   - $\leq 8.6$ psi may be delivered year-round
   - $9.6$ psi max may be delivered during winter months (Oct-Mar)
   - $> 9.6$ psi may be accepted at the discretion of COMPANY’s Manager-Oil Movements.

2. S&W:
   - $\leq 1.0\%$ volume S&W

3. Pour Point:
   - $\leq 35^\circ$ F in the winter months (Oct-Mar)
   - $\leq 55^\circ$ F anytime
Three aspects affecting hydrocarbon quality:

- **DEGRADATION** is a process that can occur when liquid hydrocarbons are transported through a system.

- **CONTAMINATION** results from the addition of an outside ingredient to liquid hydrocarbons prior to, or after, entry into the system. Intentional or accidental dumping of used lube oils, cleaning solvents or chemical byproducts are examples of contamination. Additives used to enhance production or transportation are not considered contamination.

- **ALTERATION** can occur upon the addition of an outside ingredient that is normally used in production or transportation, to liquid hydrocarbons prior to, or after, entry into the system. Examples of alteration are use of additives such as biocides, paraffin cutters, defoamers, drag reducing agents, etc. These additives are necessary in the production and/or transportation of liquid hydrocarbons and shall be used in the amounts recommended by the manufacturer. Use of these additives **shall be** reported to the Manager of Oil Movements prior to introduction into the stream. SHIPPER will be responsible for any adverse effects that these additives may cause for the COMPANY, downstream carriers and facilities, or the end user of the liquid hydrocarbons transported in the system.
Examples of Additives

Additives:
- Well treating chemicals
- Producing chemicals
- Biocides
- Corrosion Inhibitors
- Paraffin cutters
- Hydrate inhibitors

Additives **shall** only be introduced into the system when used in normal production or transportation operations as recommended by the manufacturer. They **shall not** be introduced into merchantable liquid hydrocarbon streams as a means of disposal of the additive.
Oxygenated Hydrocarbons

With the exception detailed below, oil having contaminant-oxygenated hydrocarbons **shall not** be introduced into the system:

1. Some acceptable additives (examples: hydrate inhibitors, paraffin solvents, asphaltene dispersants) contain oxygenated compounds.

2. Methanol (methyl alcohol) or additives containing methanol, such as low dose hydrate inhibitor, may be introduced; however, OWNER and SHIPPER will be responsible for assuring that the methanol content is below the levels that would adversely affect intermediate facilities and end user operations.

To help minimize these affects, COMPANY will require methanol-injecting OWNERS to adhere to the following:

- Production facilities shall remove as much methanol as possible.
- Continuous methanol injection should not exceed 50 ppm.
- If 24-hour average might exceed 50 ppm, SHIPPER must nominate the liquid hydrocarbons to a destination that is willing to accept the high methanol content, and COMPANY scheduler and operations must be able to isolate and coordinate the delivery without affecting other SHIPPERS.