**IDENTIFICATION INFORMATION**

Assessment Geologist: J.L. Coleman and R.C. Milici  
Region: North America  
Province: Appalachian Basin  
Total Petroleum System: Devonian Shale-Middle and Upper Paleozoic  
Assessment Unit: Western Margin Marcellus  
Based on Data as of: State data (Ohio, West Virginia, and Pennsylvania)  
Date: 17-Mar-11  
Number: 5  
Number: 5067  
Number: 506704  
Number: 50670469  
Notes from Assessor: 

**CHARACTERISTICS OF ASSESSMENT UNIT**

Assessment-unit type: Oil (<20,000 cfg/bo) or Gas (>20,000 cfg/bo), incl. disc. & pot. additions

What is the minimum total recovery per cell? 0.02 (mmbo for oil A.U.; bcfg for gas A.U.)

Number of tested cells: 1133

Number of tested cells with total recovery per cell ≥ minimum: >9

Established (discovered cells): X  
Hypothetical (no cells): 

Median total recovery per cell (for cells ≥ min.): (mmbo for oil A.U.; bcfg for gas A.U.)

1st 3rd discovered  
2nd 3rd  
3rd 3rd

Assessment-Unit Probabilities:

Attribute Probability of occurrence (0-1.0)

1. CHARGE: Adequate petroleum charge for an untested cell with total recovery ≥ minimum. 1.0
2. ROCKS: Adequate reservoirs, traps, seals for an untested cell with total recovery ≥ minimum. 1.0
3. TIMING: Favorable geologic timing for an untested cell with total recovery ≥ minimum. 1.0

Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3): 1.0

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**NO. OF UNTESTED CELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES**

1. Total assessment-unit area (acres): (uncertainty of a fixed value)
   
   calculated mean 25,500,000  
   minimum 24,225,000  
   mode 25,500,000  
   maximum 26,775,000

2. Area per cell of untested cells having potential for additions to reserves (acres): (values are inherently variable)
   
   calculated mean 117  
   minimum 20  
   mode 90  
   maximum 240

   uncertainty of mean: minimum 92  
   maximum 142

3. Percentage of total assessment-unit area that is untested (%): (uncertainty of a fixed value)
   
   calculated mean 99  
   minimum 99  
   mode 99.5  
   maximum 99.9
### NO. OF UNTESTED CELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES (Continued)

4. Percentage of untested assessment-unit area that has potential for additions to reserves (%):
   - (a necessary criterion is that total recovery per cell > minimum; uncertainty of a fixed value)
     - calculated mean: 7
     - minimum: 0.5
     - mode: 6.5
     - maximum: 15

   Geologic evidence for estimates:

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### TOTAL RECOVERY PER CELL

Total recovery per cell for untested cells having potential for additions to reserves:
(values are inherently variable; mmbo for oil A.U.; bcfg for gas A.U.)

<table>
<thead>
<tr>
<th></th>
<th>calculated mean</th>
<th>minimum</th>
<th>median</th>
<th>maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.13</td>
<td>0.02</td>
<td>0.05</td>
<td>5</td>
</tr>
</tbody>
</table>

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### AVERAGE COPRODUCT RATIOS FOR UNTESTED CELLS, TO ASSESS COPRODUCTS
(uncertainty of fixed but unknown values)

**Oil assessment unit:**
- Gas/oil ratio (cfg/bo)
- NGL/gas ratio (bngl/mmcfg)

**Gas assessment unit:**
- Liquids/gas ratio (bliq/mmcfg)

<table>
<thead>
<tr>
<th></th>
<th>minimum</th>
<th>mode</th>
<th>maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gas/oil ratio (cfg/bo)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NGL/gas ratio (bngl/mmcfg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Liquids/gas ratio (bliq/mmcfg)</td>
<td>40</td>
<td>60</td>
<td>80</td>
</tr>
</tbody>
</table>
### SELECTED ANCILLARY DATA FOR UNTESTED CELLS

(values are inherently variable)

#### Oil assessment unit:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Mode</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>API gravity of oil (degrees)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfur content of oil (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depth (m) of water (if applicable)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Drilling depth (m)</th>
<th>Minimum</th>
<th>F75</th>
<th>Mode</th>
<th>F25</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
</tbody>
</table>

#### Gas assessment unit:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Minimum</th>
<th>Mode</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inert-gas content (%)</td>
<td>0.00</td>
<td>0.10</td>
<td>1.00</td>
</tr>
<tr>
<td>CO₂ content (%)</td>
<td>0.00</td>
<td>0.50</td>
<td>1.00</td>
</tr>
<tr>
<td>Hydrogen sulfide content (%)</td>
<td>0.00</td>
<td>0.05</td>
<td>0.10</td>
</tr>
<tr>
<td>Heating value (BTU)</td>
<td>1000</td>
<td>1100</td>
<td>1400</td>
</tr>
<tr>
<td>Depth (m) of water (if applicable)</td>
<td>0</td>
<td>10</td>
<td>40</td>
</tr>
</tbody>
</table>

<table>
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<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1200</td>
<td>1700</td>
<td></td>
<td></td>
<td>3400</td>
</tr>
</tbody>
</table>

#### Success ratios:

<table>
<thead>
<tr>
<th>Ratio</th>
<th>Calculated mean</th>
<th>Minimum</th>
<th>Mode</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Future success ratio (%)</td>
<td>45</td>
<td>20</td>
<td>40</td>
<td>75</td>
</tr>
<tr>
<td>Historic success ratio, tested cells (%)</td>
<td>50</td>
<td></td>
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</tr>
</tbody>
</table>

#### Completion practices:

1. Typical well-completion practices (conventional, open hole, open cavity, other) conventional
2. Fraction of wells drilled that are typically stimulated slickwater, CO₂, N₂
3. Predominant type of stimulation (none, frac, acid, other) slickwater, CO₂, N₂
4. Fraction of wells drilled that are horizontal 0.1