

Appendix 1. Input Data Form for the Cretaceous Olmos Coalbed Gas Assessment Unit (50470281)

The input data form in this appendix was used for evaluating the Cretaceous Olmos Coalbed Gas Assessment Unit (50470281). The form was prepared for the U.S. Geological Survey National Oil and Gas Assessment (NOGA) so that geologists would have a consistent format to use in assessing continuous accumulations of gas. Some spaces on the form are blank because the information is not applicable to this assessment unit. To estimate the potential additions to reserves of continuous accumulations, the USGS has developed a model called “FORSPAN” (acronym for FORecast SPAN; Schmoker, 1999). The FORSPAN model treats a continuous accumulation as a collection of petroleum-containing cells for assessment purposes. A cell is a subdivision or area within a continuous accumulation having dimensions related to the drainage areas of wells. Two sources cited in this appendix (IHS Energy Group, 2005a, b) are listed below and are discussed in the body of this report in the section “Methods.”

Some abbreviations used in the input form are lowercase, and that style differs from the uppercase abbreviations used in the body of this report. The meaning of the terms is the same: bcfg=BCFG; bliq/mmcf=BLIQ/MMCFG. Definitions of the abbreviations follow: AU, assessment unit; bcfg, billion cubic feet of gas; bliq/mmcf, barrels of liquid per million cubic feet of gas; bnlg/mmcf, barrels of natural gas liquids per

million cubic feet of gas; BTU, British thermal unit; CBM, coalbed methane; cfb/bo, cubic feet of gas per barrel of oil; CO₂, carbon dioxide; disc., discovered; frac, fracture; incl., including; m, meter; min., minimum; mmbo, million barrels of oil; NGL, natural gas liquids; NO., no., number; pot., potential.

The input data form for appendix 1 is available at <https://doi.org/10.3133/ofr20171167>.

References Cited

- IHS Energy Group, 2005a [includes data current as of December 2005], PI/Dwights PLUS U.S. production data: Englewood, Colo., IHS Energy Group database.
- IHS Energy Group, 2005b [includes data current as of December 2005], PI/Dwights PLUS U.S. well data: Englewood, Colo., IHS Energy Group database.
- Schmoker, J.W., 1999, U.S. Geological Survey assessment model for continuous (unconventional) oil and gas accumulations—The “FORSPAN” model: U.S. Geological Survey Bulletin 2168, 9 p., accessed September 23, 2009, at <https://pubs.er.usgs.gov/publication/b2168>.

**FORSPAN ASSESSMENT MODEL FOR CONTINUOUS
ACCUMULATIONS--BASIC INPUT DATA FORM (NOGA, Version 9, 2-10-03)**

IDENTIFICATION INFORMATION

Assessment Geologist:	P.D. Warwick	Date:	1/26/2007
Region:	North America	Number:	5
Province:	Western Gulf	Number:	5047
Total Petroleum System:	Olmos Coalbed Gas	Number:	504702
Assessment Unit:	Cretaceous Olmos Coalbed Gas	Number:	50470281
Based on Data as of:	IHS Energy Group (2005a,b) (data current through 2005)		
Notes from Assessor:	analog: Raton Basin (50410181) and Powder River Basin (50330182)		

CHARACTERISTICS OF ASSESSMENT UNIT

Assessment-unit type: Oil (<20,000 cfg/bo) or Gas (≥20,000 cfg/bo), incl. disc. & pot. additions	Gas
What is the minimum total recovery per cell? <u>0.01</u> (mmbo for oil AU; bcfg for gas AU)	
Number of tested cells: <u>57</u>	
Number of tested cells with total recovery per cell ≥ minimum: <u>14</u>	0.245614035
Established (discovered cells): <u>X</u> Hypothetical (no cells): <u> </u>	
Median total recovery per cell (for cells ≥ min.): (mmbo for oil AU; bcfg for gas AU)	
1st 3rd discovered <u>0.012</u> 2nd 3rd <u>0.02</u> 3rd 3rd <u>0.022</u>	

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	1.0
2. ROCKS: Adequate reservoirs, traps, seals for an untested cell with total recovery ≥ minimum.	1.0	1.0
3. TIMING: Favorable geologic timing for an untested cell with total recovery ≥ minimum.	1.0	1.0
Assessment-Unit GEOLOGIC Probability (Product of 1, 2, and 3):	1.0	1.0

NO. OF UNTESTED CELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES

1. Total assessment-unit area (acres): (uncertainty of a fixed value)

calculated mean	1,043,000	minimum	939,000	mode	1,043,000	maximum	1,147,000
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2. Area per cell of untested cells having potential for additions to reserves (acres): (values are inherently variable)

calculated mean	43.3	minimum	10	mode	40	maximum	80
uncertainty of mean:	minimum	30	maximum	57			

3. Percentage of total assessment-unit area that is untested (%): (uncertainty of a fixed value)

calculated mean	99.8	minimum	99.7	mode	99.8	maximum	99.9
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Assessment Unit (name, no.)
Cretaceous Olmos Coalbed Gas, 50470281

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 \geq minimum; uncertainty of a fixed value)

calculated mean 9.7 minimum 1 mode 8 maximum 20

Geologic evidence for estimates:

At the mode, 33% of the AU has greatest potential for CBM and 25% of that would have recoveries > 0.01 bcfg.

TOTAL RECOVERY PER CELL

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

calculated mean 0.033 minimum 0.01 median 0.03 maximum 0.1

AVERAGE COPRODUCT RATIOS FOR UNTESTED CELLS, TO ASSESS COPRODUCTS

(uncertainty of fixed but unknown values)

<u>Oil assessment unit:</u>	minimum	mode	maximum
Gas/oil ratio (cfg/bo)	<u> </u>	<u> </u>	<u> </u>
NGL/gas ratio (bnlq/mmcf)	<u> </u>	<u> </u>	<u> </u>
<u>Gas assessment unit:</u>			
Liquids/gas ratio (bliq/mmcf)	<u>0</u>	<u>0</u>	<u>13</u>

SELECTED ANCILLARY DATA FOR UNTESTED CELLS

(values are inherently variable)

<u>Oil assessment unit:</u>		minimum	mode	maximum
API gravity of oil (degrees)		_____	_____	_____
Sulfur content of oil (%)		_____	_____	_____
Depth (m) of water (if applicable)		_____	_____	_____

Drilling depth (m)

minimum	F75	mode	F25	maximum
_____	_____	_____	_____	_____

Gas assessment unit:

		minimum	mode	maximum
Inert-gas content (%)		0.30	0.63	1.00
CO ₂ content (%)		0.10	0.20	0.50
Hydrogen sulfide content (%)		0.00	0.00	0.00
Heating value (BTU)		1000	1075	1200
Depth (m) of water (if applicable)		_____	_____	_____

Drilling depth (m)

minimum	F75	mode	F25	maximum
60	310	490	800	1060

Success ratios:

	calculated mean	minimum	mode	maximum
Future success ratio (%)	25	10	25	40

Historic success ratio, tested cells (%) 25

Completion practices:

- | | |
|--|--------------|
| 1. Typical well-completion practices (conventional, open hole, open cavity, other) | conventional |
| 2. Fraction of wells drilled that are typically stimulated | 1 |
| 3. Predominant type of stimulation (none, frac, acid, other) | frac & acid |
| 4. Fraction of wells drilled that are horizontal | 0 |
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ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO STATES
Surface Allocations (uncertainty of a fixed value)

1.	<u>Texas</u>	represents	<u>100.00</u>	area % of the AU
	<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
	Volume % in entity	_____	_____	_____
	<u>Gas in gas assessment unit:</u>			
	Volume % in entity	_____	<u>100</u>	_____
2.	_____	represents	_____	area % of the AU
	<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
	Volume % in entity	_____	_____	_____
	<u>Gas in gas assessment unit:</u>			
	Volume % in entity	_____	_____	_____
3.	_____	represents	_____	area % of the AU
	<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
	Volume % in entity	_____	_____	_____
	<u>Gas in gas assessment unit:</u>			
	Volume % in entity	_____	_____	_____
4.	_____	represents	_____	area % of the AU
	<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
	Volume % in entity	_____	_____	_____
	<u>Gas in gas assessment unit:</u>			
	Volume % in entity	_____	_____	_____
5.	_____	represents	_____	area % of the AU
	<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
	Volume % in entity	_____	_____	_____
	<u>Gas in gas assessment unit:</u>			
	Volume % in entity	_____	_____	_____
6.	_____	represents	_____	area % of the AU
	<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
	Volume % in entity	_____	_____	_____
	<u>Gas in gas assessment unit:</u>			
	Volume % in entity	_____	_____	_____

7. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

8. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

9. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

10. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

11. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

12. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO GENERAL LAND OWNERSHIPS
Surface Allocations (uncertainty of a fixed value)

1. <u>Federal lands</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
2. <u>Private lands</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
3. <u>Tribal lands</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
4. <u>Other lands</u>	_____	represents	100.00	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>			100	
Volume % in entity	_____		_____	_____
5. <u>State 1 lands</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
6. _____	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____

7. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

8. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

9. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

10. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

11. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

12. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO FEDERAL LAND SUBDIVISIONS
Surface Allocations (uncertainty of a fixed value)

1. <u>Bureau of Land Management (BLM)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
2. <u>BLM wilderness areas (BLMW)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
3. <u>BLM roadless areas (BLMR)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
4. <u>National Park Service (NPS)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
5. <u>NPS wilderness areas (NPSW)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____
6. <u>NPS protected withdrawals (NPSP)</u>	_____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum		mode	maximum
Volume % in entity	_____		_____	_____
<u>Gas in gas assessment unit:</u>				
Volume % in entity	_____		_____	_____

Assessment Unit (name, no.)
Cretaceous Olmos Coalbed Gas, 50470281

7. <u>United States (U.S.) Forest Service (FS)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
8. <u>U.S.FS wilderness areas (FSW)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
9. <u>U.S.FS roadless areas (FSR)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
10. <u>U.S.FS protected withdrawals (FSP)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
11. <u>U.S. Fish and Wildlife Service (FWS)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
12. <u>U.S.FWS wilderness areas (FWSW)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

Assessment Unit (name, no.)
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<u>13. U.S.FWS protected withdrawals (FWSP)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
<u>14. Wilderness study areas (WS)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
<u>15. U.S. Department of Energy (DOE)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
<u>16. U.S. Department of Defense (DOD)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
<u>17. Bureau of Reclamation (BOR)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
<u>18. Tennessee Valley Authority (TVA)</u>	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

Assessment Unit (name, no.)
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19. Other Federal represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

20. _____ represents _____ area % of the AU

<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____

<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS
Surface Allocations (uncertainty of a fixed value)

1. <u>Rio Grande plain (RGPL)</u>	represents	<u>95.02</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	<u>95.02</u>	_____
2. <u>Stockton plateau (STPT)</u>	represents	<u>4.98</u>	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	<u>4.98</u>	_____
3. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
4. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
5. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____
6. _____	represents	_____	area % of the AU
<u>Oil in oil assessment unit:</u>	minimum	mode	maximum
Volume % in entity	_____	_____	_____
<u>Gas in gas assessment unit:</u>			
Volume % in entity	_____	_____	_____

7. _____ represents _____ area % of the AU

Oil in oil assessment unit: minimum mode maximum
Volume % in entity _____ _____ _____

Gas in gas assessment unit:
Volume % in entity _____ _____ _____

8. _____ represents _____ area % of the AU

Oil in oil assessment unit: minimum mode maximum
Volume % in entity _____ _____ _____

Gas in gas assessment unit:
Volume % in entity _____ _____ _____

9. _____ represents _____ area % of the AU

Oil in oil assessment unit: minimum mode maximum
Volume % in entity _____ _____ _____

Gas in gas assessment unit:
Volume % in entity _____ _____ _____

10. _____ represents _____ area % of the AU

Oil in oil assessment unit: minimum mode maximum
Volume % in entity _____ _____ _____

Gas in gas assessment unit:
Volume % in entity _____ _____ _____

11. _____ represents _____ area % of the AU

Oil in oil assessment unit: minimum mode maximum
Volume % in entity _____ _____ _____

Gas in gas assessment unit:
Volume % in entity _____ _____ _____

12. _____ represents _____ area % of the AU

Oil in oil assessment unit: minimum mode maximum
Volume % in entity _____ _____ _____

Gas in gas assessment unit:
Volume % in entity _____ _____ _____
