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Chapter 2

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

IDENTIFICATION INFORMATION

Assessment Geologist:	M.A. Kirschbaum	Date:	19-Feb-08
Region:	North America	Number:	5
Province:	Bighorn Basin	Number:	5034
Total Petroleum System:	Cretaceous-Tertiary Composite	Number:	503402
Assessment Unit:	Mowry Fractured Shale Continuous Oil	Number:	50340262
Based on Data as of:	IHS Energy (2007)		

Notes from Assessor: Powder River Basin Mowry Continuous Oil (50330261) assessment unit used as analog.

CHARACTERISTICS OF ASSESSMENT UNIT

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

What is the minimum total recovery per cell? 0.002 (mmbo for oil AU; bcfg for gas AU)

Number of tested cells: 0

Number of tested cells with total recovery per cell ≥ minimum: 0

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

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

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

NO. OF UNTESTED CELLS WITH POTENTIAL FOR ADDITIONS TO RESERVES

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

   calculated mean 646,000 minimum 581,000 mode 646,000 maximum 710,000

2. Area per cell of untested cells having potential for additions to reserves (acres): (values are inherently variable)

   calculated mean 290 minimum 40 mode 185 maximum 640

   uncertainty of mean: minimum 240 maximum 340

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

   calculated mean 100 minimum 100 mode 100 maximum 100

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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 6 minimum 0.1 mode 1.25 maximum 17

Geologic evidence for estimates:

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 0.04 minimum 0.002 median 0.025 maximum 0.35

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

Oil assessment unit:	minimum	mode	maximum
Gas/oil ratio (cfg/bo)	500	1000	1500
NGL/gas ratio (bngl/mmcfg)	30	60	90
Gas assessment unit:			
Liquids/gas ratio (bliq/mmcfg)			

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SELECTED ANCILLARY DATA FOR UNTESTED CELLS

(values are inherently variable)

Oil assessment unit:	minimum	mode	maximum
API gravity of oil (degrees)	40	45	50
Sulfur content of oil (%)	0	0.1	0.3
Depth (m) of water (if applicable)			

Drilling depth (m)

minimum	F75	mode	F25	maximum
2400	2800	3000	3300	3600

Gas assessment unit:	minimum	mode	maximum
Inert-gas content (%)			
CO_2 content (%)			
Hydrogen sulfide content (%)			
Heating value (BTU)			
Depth (m) of water (if applicable)			

Drilling depth (m)

minimum	F75	mode	F25	maximum

Success ratios:	calculated mean	minimum	mode	maximum
Future success ratio (%)	28	10	25	50

Historic success ratio, tested cells (%) _____

Completion practices:

1. Typical well-completion practices (conventional, open hole, open cavity, other)	conventional
2. Fraction of wells drilled that are typically stimulated	100
3. Predominant type of stimulation (none, frac, acid, other)	hydrofrac
4. Fraction of wells drilled that are horizontal	90

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

1. Wyoming represents 100 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		100	
Gas in gas assessment unit: Volume % in entity			

2. _____ represents _____ area % of the AU

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

3. _____ represents _____ area % of the AU

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

4. _____ represents _____ area % of the AU

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

5. _____ represents _____ area % of the AU

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

6. _____ represents _____ area % of the AU

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

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7. _____ represents _____ area % of the AU

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

8. _____ represents _____ area % of the AU

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

9. _____ represents _____ area % of the AU

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

10. _____ represents _____ area % of the AU

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

11. _____ represents _____ area % of the AU

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

12. _____ represents _____ area % of the AU

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

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

1. Federal Lands represents 74.43 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		75	
Gas in gas assessment unit: Volume % in entity			

2. Private Lands represents 20.77 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		21	
Gas in gas assessment unit: Volume % in entity			

3. Tribal Lands represents _____ area % of the AU

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

4. Other Lands represents 0.18 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		0	
Gas in gas assessment unit: Volume % in entity			

5. WY State Lands represents 4.62 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		4	
Gas in gas assessment unit: Volume % in entity			

6. _____ represents _____ area % of the AU

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

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7. _____ represents _____ area % of the AU

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

8. _____ represents _____ area % of the AU

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

9. _____ represents _____ area % of the AU

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

10. _____ represents _____ area % of the AU

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

11. _____ represents _____ area % of the AU

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

12. _____ represents _____ area % of the AU

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

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

1. Bureau of Land Management (BLM) represents 73.04 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		74.9	
Gas in gas assessment unit: Volume % in entity			

2. BLM Wilderness Areas (BLMW) represents _____ area % of the AU

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

3. BLM Roadless Areas (BLMR) represents _____ area % of the AU

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

4. National Park Service (NPS) represents _____ area % of the AU

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

5. NPS Wilderness Areas (NPSW) represents _____ area % of the AU

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

6. NPS Protected Withdrawals (NPSP) represents _____ area % of the AU

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

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7. US Forest Service (FS) represents _____ area % of the AU

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

8. USFS Wilderness Areas (FSW) represents _____ area % of the AU

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

9. USFS Roadless Areas (FSR) represents _____ area % of the AU

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

10. USFS Protected Withdrawals (FSP) represents _____ area % of the AU

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

11. US Fish and Wildlife Service (FWS) represents _____ area % of the AU

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

12. USFWS Wilderness Areas (FWSW) represents _____ area % of the AU

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

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13. USFWS Protected Withdrawals (FWSP) represents _____ area % of the AU

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

14. Wilderness Study Areas (WS) represents _____ area % of the AU

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

15. Department of Energy (DOE) represents _____ area % of the AU

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

16. Department of Defense (DOD) represents _____ area % of the AU

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

17. Bureau of Reclamation (BOR) represents 1.39 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		0.1	
Gas in gas assessment unit: Volume % in entity			

18. Tennessee Valley Authority (TVA) represents _____ area % of the AU

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

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19. Other Federal represents _____ area % of the AU

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

20. _____ represents _____ area % of the AU

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

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ALLOCATIONS OF POTENTIAL ADDITIONS TO RESERVES TO ECOSYSTEMS

Surface Allocations (uncertainty of a fixed value)

1. Bighorn Basin (BHBA) represents 100.00 area % of the AU

	minimum	mode	maximum
Oil in oil assessment unit: Volume % in entity		100	
Gas in gas assessment unit: Volume % in entity			

2. _____ represents _____ area % of the AU

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

3. _____ represents _____ area % of the AU

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

4. _____ represents _____ area % of the AU

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

5. _____ represents _____ area % of the AU

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

6. _____ represents _____ area % of the AU

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

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7. _____ represents _____ area % of the AU

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

8. _____ represents _____ area % of the AU

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

9. _____ represents _____ area % of the AU

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

10. _____ represents _____ area % of the AU

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

11. _____ represents _____ area % of the AU

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

12. _____ represents _____ area % of the AU

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

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