Nature and Characteristics of Water Co-Produced with Coalbed Methane with emphasis on the Powder River Basin

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USGS
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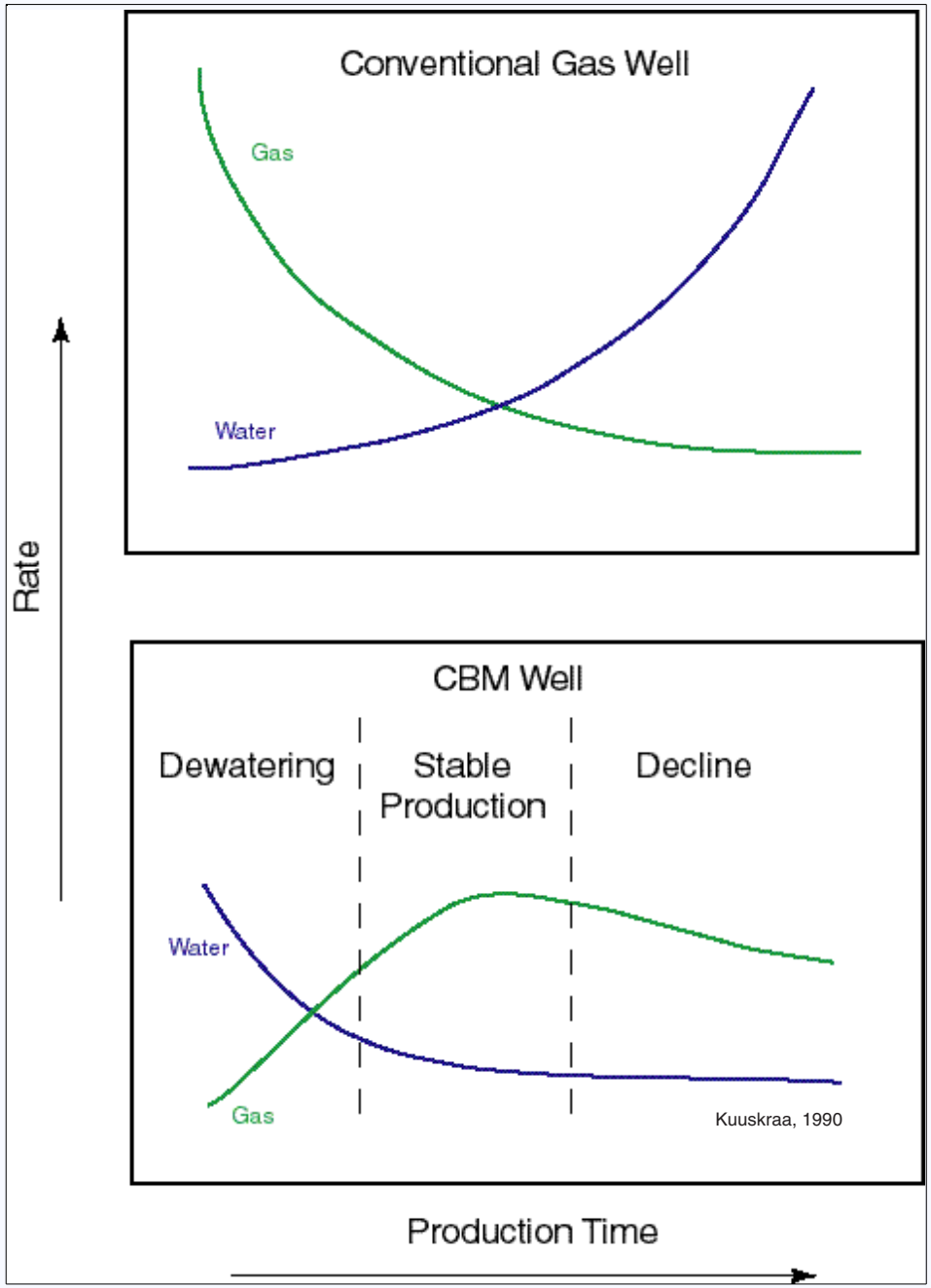
Overview

- Origin
- CBM vs conventional gas well
- Volumes
- Composition
- Fate
- USGS Studies

Origin of Water

- Depositional water
- Reaction water (from coalification)
- Meteoric water (rainfall or recharge)
- Water from other rock units
- Mixture

CBM vs Conventional Gas Well



Volumes of Water in Major Basins

Basin	State	# Wells	Average Water Production Bbl/ day / well	Water / Gas Bbl/Mcf
Black Warrior	Al	2,917	58	0.55
Powder River	WY MT	4,454	275	2.17
Raton	CO	459	266	1.34
San Juan	CO NM	3,089	25	0.031
Uinta	UT	393	215	0.42

Composition of CBM Water

- Measured in mg/L (ppm) or µg/L (ppb)
- Important parameters include:
  - Total Dissolved Solids (salt)
  - pH and Temperature
  - Major Cations (Na, K, Mg, Ca)
  - Major Anions (Cl, SO_4, HCO_3)
  - Trace elements (Fe, Mn, Ba, Cr, As, Se, Hg)
  - Organics (DOC, hydrocarbons, additives)
- Varies intra- and inter-basin with depth, depositional environment, lithology

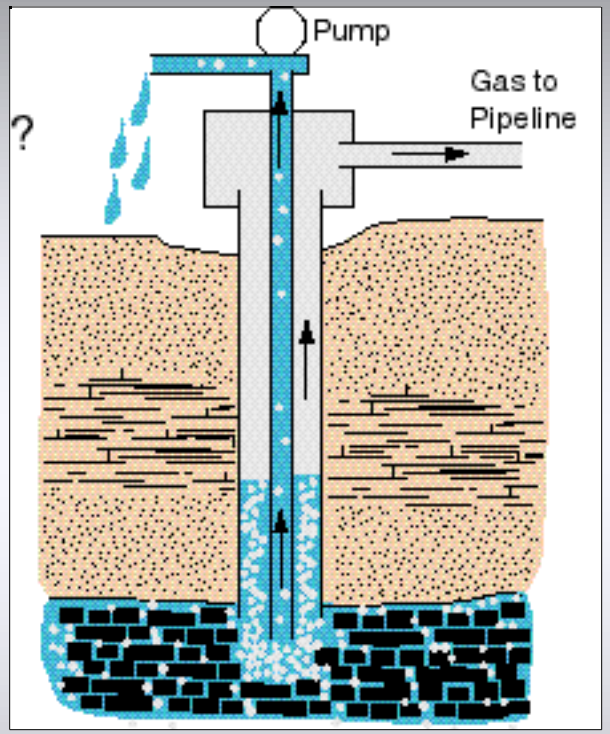
Composition of Water in Major Basins

Basin	State	Type	Total Dissolved Solids mg/L	pH
Black Warrior	Al	Na-Cl-HCO_3	160-31,000	5.4-9.9
Powder River	WY MT	Na-HCO_3	270-3,010	6.8-8.0
Raton	CO	Na-HCO_3	530-6,000	ND
San Juan	CO NM	Na-HCO_3-Cl	410-171,000	5.2-9.2
Uinta	UT	Na-HCO_3-Cl	6,350-42,700	7.0-8.2

Fate of CBM Water

Discharge to drainages, streams, stock ponds, reservoirs, evaporation ponds

(NPDES permit)



Injection for disposal or storage or to recharge shallow aquifers

(UIC)

Treatment ??

Cost of Produced Water Handling

Increasing Cost

- Discharge—no treatment
- Discharge with treatment
- Treatment and reuse
- Treatment, reuse or discharge, and disposal of residues
- On-site injection
- Off-site injection (trucking)

Concerns Related to Water and CBM Development

- Water
  - Withdrawal—Loss of resource; effect on groundwater
  - Disposal—Quality of water; effect on soils and drainages, ground & surface water, plants
  - Wetlands—Creation & loss of habitat; metal toxicity
- Methane Outgassing
  - In water wells, houses, soils, outcrops

U.S. Geological Survey Studies

- Cooperative initiatives with BLM, WY State offices, CBM producers
- Survey of water produced from CBM wells—basin-wide
- Tritium and chemical analyses of monitoring wells in Wasatch & Ft. Union Formations
- Pilot studies for other isotopes for dating
- Pilot studies for survey of organic components

References

Kuuskraa, V. A., 1990, Summary of coalbed methane technology and economics in coalbed workshop: Gas Research Institute, Denver, CO, March, 1990.