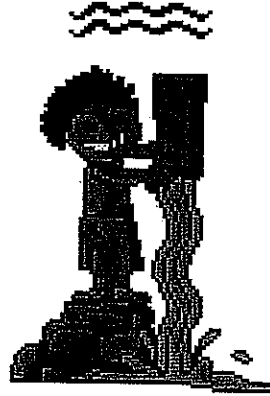


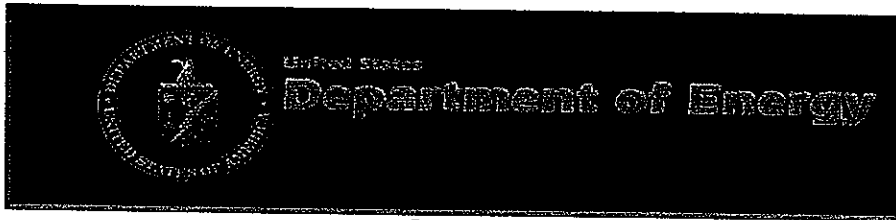
Onshore and CBM Wells Produce Water Too: Hot Issues on Management Practices and Regulatory Requirements

John A. Veil
Argonne National
Laboratory



Acknowledgements

John Veil's work is funded by:



and the



Topics for Discussion



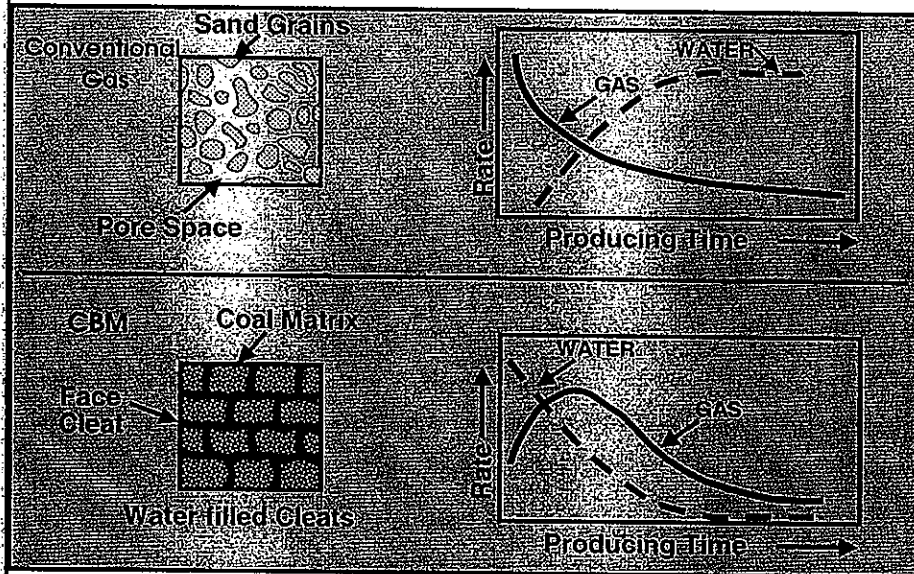
- **Background on coal bed methane (CBM)**
- **U.S. national discharge requirements**
- **The permitting process**
- **Applicability to CBM water**

What is Coalbed Methane ?

- **Natural Gas = Methane (CH₄)**
- **Generated within coal seams as a result of the "Coalification" Process**

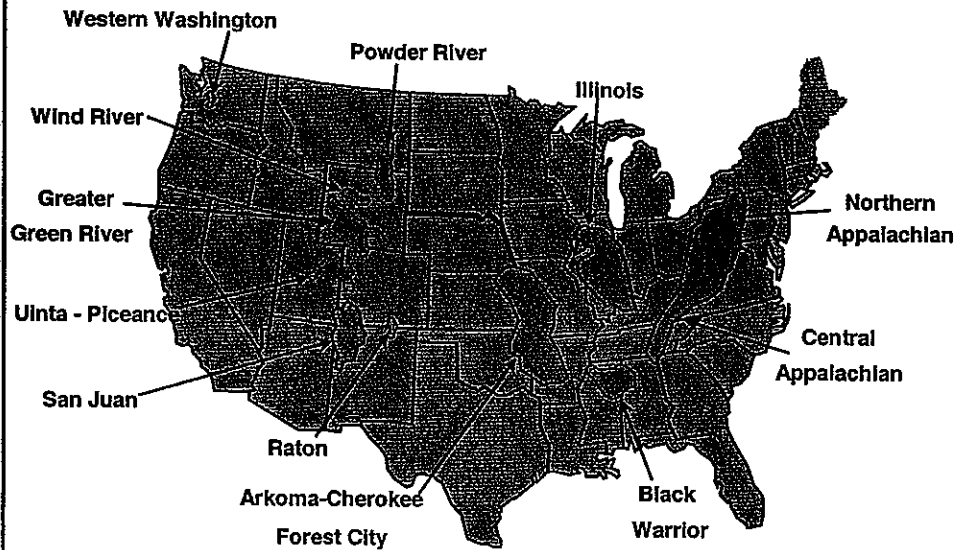


Conventional vs. CBM Well Behavior



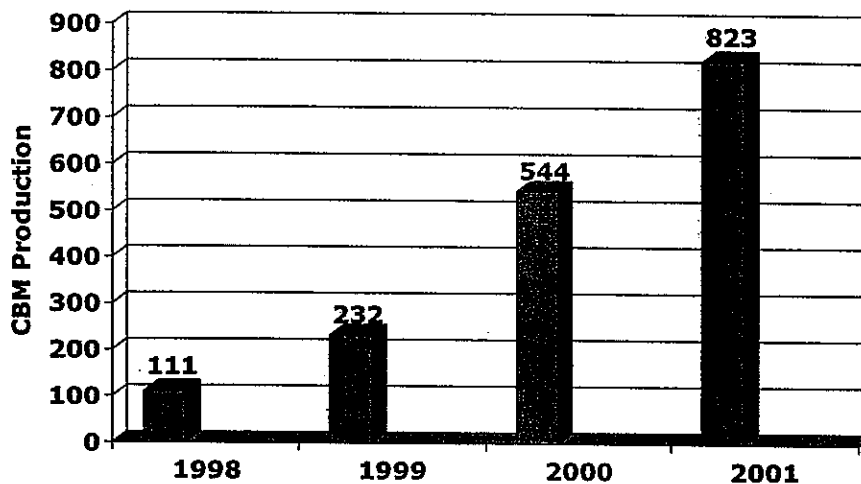
Source: S. DeAlbuquerque, ConocoPhillips

Major Coalbed Methane Basins



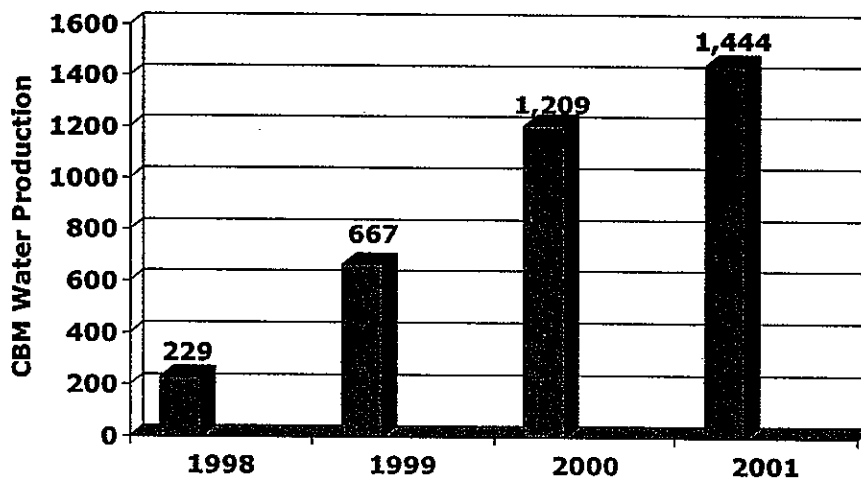
Source: S. DeAlbuquerque, ConocoPhillips

CBM Production in Powder River Basin (MMcf/day)



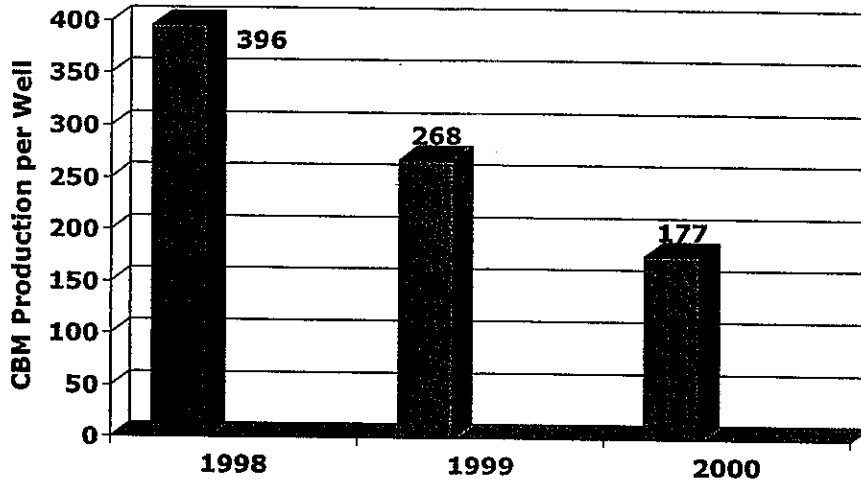
Source: DOE/NETL report 11/02

CBM Water Production in Powder River Basin (thousand bbls/day)



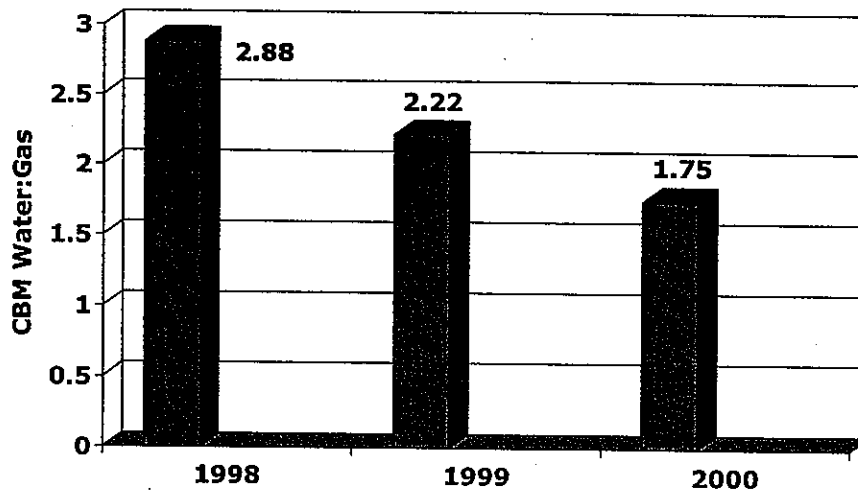
Source: DOE/NETL report 11/02

CBM Water Production per Well in Powder River Basin (bbls/day)



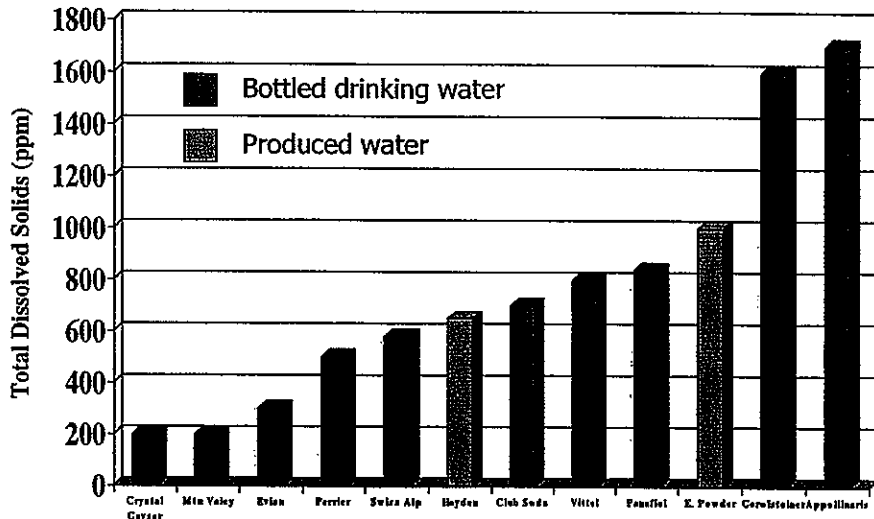
Source: DOE/NETL report 11/02

CBM Water/Gas Ratio (bbls/Mcf)



Source: DOE/NETL report 11/02

Relative CBM Water Quality



Source: S. DeAlbuquerque, ConocoPhillips

CBM Produced Water Salinity

	<u>Average</u>	<u>Range</u>
San Juan:	15,600	1,500 - 20,000
Black Warrior:	12,500	700 - 37,400
Western Uinta:	11,000	6,400 - 19,600
W. Powder River:	1,500	1,000 - 3,000
E. Powder River:	1,000	800 - 2,000
NW Colorado:	2,000	650 - 5,200
Xing Xiam China:	700	460 - 1,050

Source: S. DeAlbuquerque, ConocoPhillips

U.S. Requirements for Discharging



Laws

- > Clean Water Act



Discharge Regulations

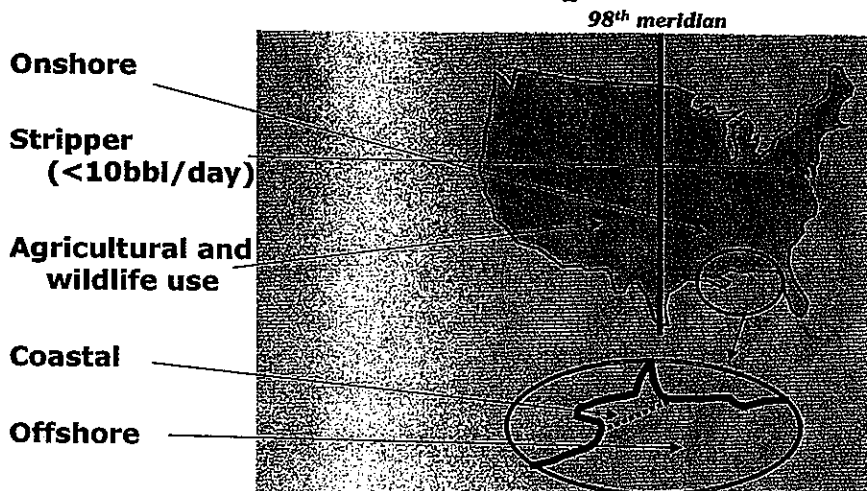
- > National Pollutant Discharge Elimination System (NPDES) program
- > Effluent limitations guidelines (ELGs)



Permits and Guidance

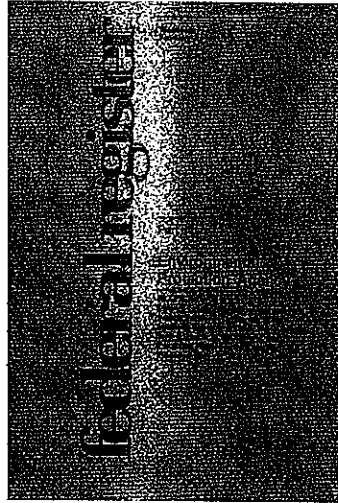
- > Environmental Protection Agency (EPA) or delegated states issue NPDES permits for discharges

EPA Oil and Gas Effluent Limitations Guidelines (ELGs) [40 CFR 435]



Offshore and Coastal ELGs

- **Best Available Technology (BAT) for offshore produced water:**
 - Oil and grease limits before discharge
 - > 29 mg/l monthly average
 - > 42 mg/l daily maximum
- **BAT for coastal produced water**
 - zero discharge except in Cook Inlet, Alaska
 - Offshore limits are required there

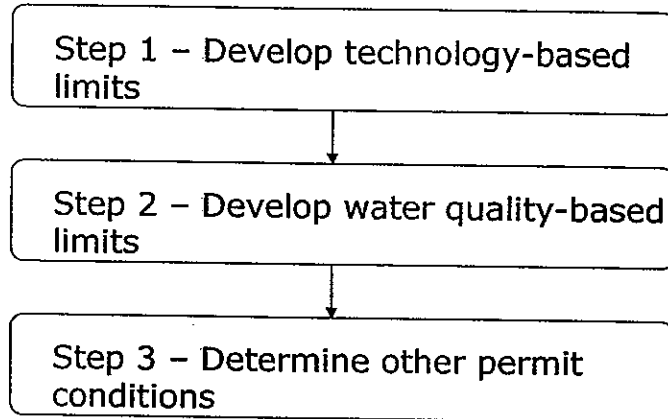


ELGs for Wells Located Onshore

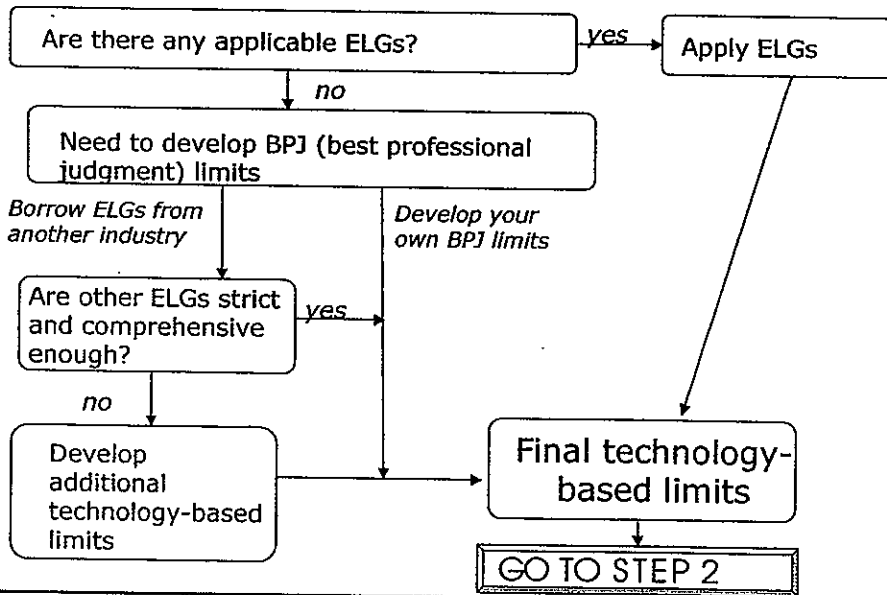
- **Onshore subcategory**
 - zero discharge
- **Stripper subcategory**
 - No national requirements
 - Jurisdiction left to state or EPA region
- **Agricultural and Wildlife Use subcategory**
 - produced water must have a use
 - > Water must be of good enough quality for wildlife, livestock, or other agricultural use
 - > Produced water must actually be put to that use
 - Oil and grease limit of 35 mg/l maximum



Establishing NPDES Permit Limits and Conditions – Simplified Overview



Establishing NPDES Permit Limits and Conditions Step 1 - Develop Technology-based Limits



Establishing NPDES Permit Limits and Conditions Step 2 - Develop Water Quality-based Limits

Do technology-based limits developed in step 1 protect water quality?
-determine background concentrations of pollutants and dilution
-compare concentrations to water quality standards

yes

no

Develop water quality-based limits:
-stricter limits for pollutants already covered by technology-based limits
-limits for other pollutants not covered by technology-based limits
May need to do modeling and determine mixing zone

Final water quality-based limits

GO TO STEP 3

Establishing NPDES Permit Limits and Conditions Step 3 - Determine Other Permit Conditions

Use numerical limits developed in steps 1 and 2 and determine monitoring and reporting methods and frequency

Are other types of controls necessary?
-best management practices plans
-operational requirements
-restrictions on flow or other activities

no

yes

Develop other types of controls and add to permit

Final permit

How Does This Relate to CBM Produced Water?



- During development of oil and gas industry ELGs, EPA did not envision or study CBM industry
- Some parties suggest that oil and gas industry ELGs are not relevant to CBM water
 - CBM water is more like drainage from coal mines (regulated by coal mining ELGs at 40 CFR 434) than produced water from conventional oil and gas production
 - CBM water could be regulated by BPJ

History of CBM Water Regulation



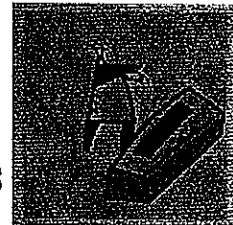
- Alabama fought the early battles
 - In the mid-1970s, CBM was produced for mine safety, not as a product
 - During Arab oil embargo, natural gas prices rose, and coal companies tried to collect and sell the gas
 - In early 1980s, Alabama producers petitioned EPA Region 4 for relief from oil and gas ELGs
 - Being east of 98th meridian, Agricultural and Wildlife subcategory did not apply
 - EPA agreed that, at least in Alabama, CBM water was not regulated by oil and gas ELGs

Permitting Practices in Alabama



- **Alabama DEM originally issued NPDES permits based on coal ELGs and other water quality-based limits**
- **Currently, permits contain:**
 - **Limits on pH, Fe, Mn, BOD, oil and grease, DO**
 - **Monitoring for conductivity, chlorides, effluent toxicity**
 - **Install diffuser**
 - **BMP plan**

Permitting Practices in Region 8



- **WY, MT, and CO have NPDES primacy except for:**
 - **Tribal lands in all 3 states**
 - **Federal facilities in CO**
- **Each state has elected to develop permits with limits based on BPJ and water quality protection**
 - **Did not use oil and gas/agricultural and wildlife use ELGs**

Related Federal Activities

- **EPA Region 8 is preparing a study assessing water management options, effectiveness and cost**
 - Would help EPA write permits for tribal lands
 - Could be used by environmental advocacy groups to challenge permits issued by states
 - Draft study should be ready soon
- **EPA headquarters, ELG office has been petitioned to develop new ELGs for CBM water**
 - No decision made on this
- **BLM is developing EISs for CBM production on federal lands**
 - Draft EIS for MT and WY released in 2/02
 - Final EIS for MT and WY expected in 2/03



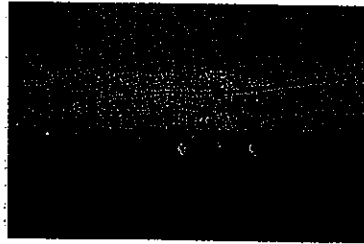
Discussion



- **For first few CBM discharges, states can carefully assess impacts**
- **When hundreds or thousands of new wells are drilled and huge volumes of water are produced in historically arid areas, situation becomes more complicated. Impacts on:**
 - Surface water hydrology
 - Ground water elevation and water quality
 - Soils/crops
 - Western culture

Other Water Management Options

- **Types of options**
 - **Injection**
 - > **Shallow – aquifer recharge**
 - > **Deep – disposal**
 - **Land application**
 - > **Irrigation**
 - **Storage and evaporation**
 - **Livestock and wildlife water supplies**
 - **Beneficial reuse**
- **Considerations in selecting options**
 - **What do regulations allow?**
 - **Cost**
 - **Ease of regulatory approval**
 - **Technical feasibility**



Final Thoughts

- **National Energy Strategy counts on expansion of CBM production**
- **Need strategies to manage water with both environmental protection and affordable costs**
- **EPA study on water treatment options and costs should provide useful information**
 - **States may elect to but are not required to follow the findings and recommendations of the EPA study**
- **Release of final EISs should open up more production**
- **Communication between stakeholders is necessary to meet the dual concerns of environmental protection and energy supply**

