

UNDERGROUND COAL GASIFICATION

U.S. REGULATORY FRAMEWORK

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Underground Coal Gasification (UCG) Presentation Topics

- **Federal Authority Regulating UCG Development**
- **Wyoming Regulations/Experience**
- **Wyoming Permitting Requirements**
- **Major UCG Problems, Issues, and Challenges**
 - Groundwater Contamination
 - UCG Subsidence
 - Competing Energy Technologies for the same Resources



Underground Coal Gasification Regulations Federal Authority

- Safe Drinking Water Act (EPA administered)
- Underground Injection Control (UIC) Program (EPA administered)
- Surface Mining Reclamation & Control Act (OSM administered)
- National Environmental Policy Act (Federal Projects)
- Endangered Species Act
- Mineral Leasing Act
- Antiquities Act
- Archaeological Resources Public Protection Act



UCG Development and Regulations in Wyoming

- **Abundant Thick, Deep, Subbituminous Coals**
- **Most U.S. UCG Tests Conducted in Wyoming (1976-1995)**
 - Hanna (7), Hoe Creek (3), Rawlins (2), Rocky Hill 1 (1), Rocky Mountain 1 (1), Carbon County UCG (1)
- **Commercial UCG Interest in the Powder River Basin (GasTech Inc.)**
- **Wyoming Maintains Regulatory Primacy - “as Stringent as Federal Rules”**
- **Wyoming Developed Environmental Regulations Specific to In Situ Technologies (UCG and In Situ Uranium Mining)**
 - Surface Regulated as Surface Coal Mine
 - Subsurface Regulated Under Special In Situ Mining Rules and Regulations



Wyoming UCG Permitting

- **Two Permitting Tracts**
 - R&D Testing License (Test Area)
 - Permit to Mine (Commercial Area)
- **Extensive Endeavor**
 - Requires Large Costs (>\$500 k) and Manpower
 - Long Time Frame (18-24 Months)
- **Permitting Requirements**
 - Adjudication File: Legal Information and Reclamation Bond
 - Supportive Information: Land Use, Archeology, Geology, Hydrology & Water Rights, Vegetation, Wildlife, Wetlands, Alluvial Valley Floors



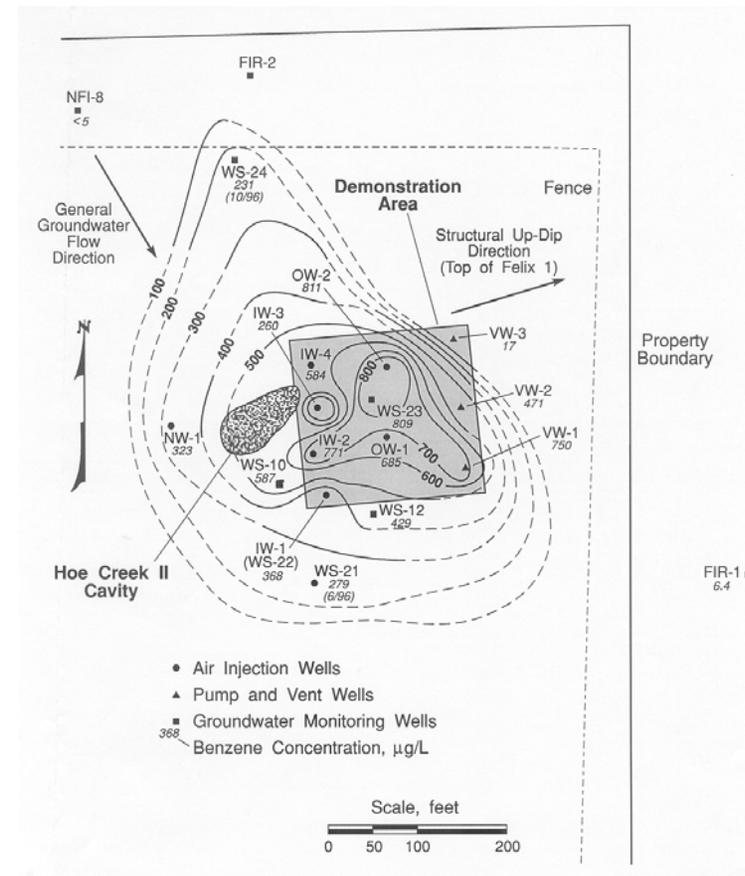
Wyoming UCG Permitting (Continued)

- **Permitting Requirements (Continued)**
 - Mine Plan: Process Description and Design, Layout, Waste Disposal, Monitoring
 - Reclamation Plan: Bond Calculation, Shutdown Procedures, Groundwater Restoration and Monitoring, Surface Reclamation
 - Review Process (60-180 Days)
 - Completeness Review
 - Technical Review
 - Public Notice
 - Appeals Process



UCG Groundwater Contamination

- **Issue - Challenge**
 - Perceived as “Dirty Technology”
 - Groundwater Contamination
 - Based on Hoe Creek
- **Actual US Experience**
 - Relatively Clean Technology
 - Most U.S. UCG Operations Resulted in Limited or No Groundwater Contamination
 - Groundwater Contamination Caused by Gas Losses
 - Dynamic Process-Consumes Deposited Contamination Sources
- **Mitigation**
 - Site Selection
 - Operation Constraints
 - Clean-Cavity Concept



UCG Subsidence

- **Real Issue**
 - Gas Losses
 - Interconnection of Water Bearing Units
 - Surface Disruption
 - Water Influx
- **Mitigation**
 - Site Selection
 - Depth
 - Module Design



Conflicting Recovery Technologies

Coal Mining, CBM, and UCG

- **No Definitive Regulations - Evolving**

- Conflict in PRB of Wyoming Between Mining and CBM
- BLM Addressing Issue
 - CBM New Technology After Mining Leases Issued
 - Lease Seniority (Oil-Gas Senior to Mining Leases)
 - Advantage to New technologies
 - Incentives to Recover CBM Near Coal Mines to Free Mine leases
 - First Approach is Negotiations Between Lease Holders
 - Prompted BLM to Issue HR 2952, the Powder River Basin Development Act of 2001
 - Additional Guidance Issued in May 2006



Wyoming CBM Clearinghouse



Wyoming CBM Clearinghouse



Rocky Mountain 1 UCG Site

Conflicting Recovery Technologies Coal Mining, CBM, and UCG (Continued)

- **See Following for Details of Conflict Resolutions**
 - <http://www.blm.gov/nhp/news/legislative/pages/2001/te011011.htm>
 - <http://www.blm.gov/nhp/news/legislative/pages/203/te030712.htm>
 - <http://www.blm.gov/nhp/efoia/wo/fy06/im2006-153.htm>
- **UCG Conflicts with Coal Mining and CBM**
 - Has Not Been Addressed - UCG not Commercial
 - Similar Lease Position as Coal Mine Lease
 - UCG Development in PRB Will Likely Be in CBM Depleted Areas
 - Not Much of a Problem Because of the Maturity of CBM Development and the Time Lag for Commercial UCG Development
 - UCG Conflicts More Likely with CBM Than Coal Mining
 - UCG Resources Deeper Than Coal Mining Resources

