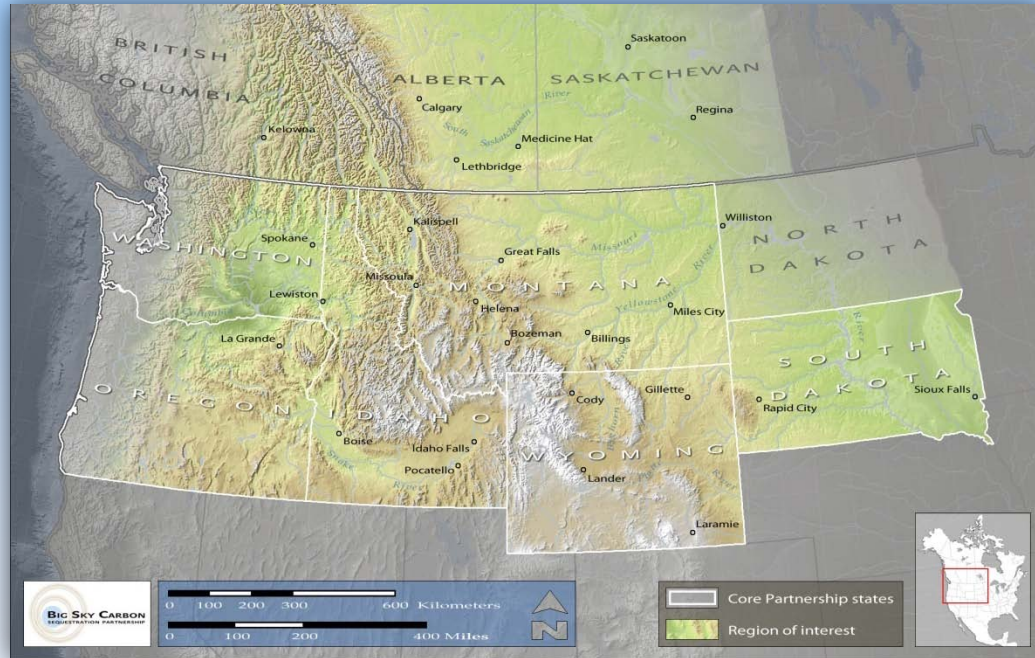


Regulatory and Policy Considerations for Site Characterization



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Ideal Geologic Formations & Surface Considerations

- Large storage capacity per unit of reservoir volume
 - High porosity
 - High permeability
- Below a depth at which CO₂ remains in a super-critical state (~2,500')
- A caprock that prohibits vertical migration of CO₂
- Water quality
- Low population density
- Surface ownership (contiguous)
- Aesthetics
- Land use
- Surface occupancy stipulations
- Serviceability
- Pipeline access
- Injection stream constituents and wind patterns

Regulatory and Economic Constraints

- Regulatory Constraints
 - NIMBY
 - Misinformation regarding regulatory analogs
 - Lack of experience with sequestration that is not EOR
 - Infrastructure development
 - Ownership
- Economic Constraints
 - CO₂ purity
 - Infrastructure
 - Distance
 - MMV
 - Liability
 - Value of CO₂
 - Litigation
 - Operation and maintenance costs
 - Scale

Socio-political Considerations

- Competing Science
- The “Precautionary Principle”
- Lack of characterization data
- Regulatory and policy uncertainty
- Federal Preemption
- Competing Uses
- The perfect site geologically may not be the perfect site politically

What else?

The What Else?

Economics

- Characterization Costs
- Capture Costs
- Distance from source to sink
- Pipeline costs
- Well costs including injection and monitoring wells
- Pore space costs
- Permitting costs
- Monitoring costs and monitoring frequency
- Potential for EOR or ECBM to reduce project costs
- Availability of State and/or Federal incentives
- Financial responsibility
- Liability
- Mitigation

The What Else?

Regulatory Considerations

- Site Characterization Requirements – AoR
- Pipeline Permitting Requirements – Varies by State
- State or Federal Primacy for UIC – Varies by State
- MMV Requirements – BACT
- MMV Requirements – Frequency, Methodology, and Duration
- Surface Ownership and Mineral Ownership – Split Estate
- Unitization Requirements
- Water Quality, Water Displacement, Pressure Front Impacts
- Cultural, Threatened and Endangered Species, Wildlife Impacts
- Other Surface Stipulations
- Demonstration of Financial Responsibility
- Post Closure Liability – Third Party Assumption and Timing
- Site Closure Requirements and Monitoring
- Risk Management and Mitigation Strategies
- Evolving Regulatory Frameworks

Big Sky Region Regulatory Approaches to CCS

- To date, Wyoming, Montana, Washington, and North Dakota have developed specific statutory requirements to regulate geologic sequestration of CO₂
- Oregon, South Dakota and Washington also have terrestrial sequestration statutes to establish registries and to promote carbon markets for agricultural and forestry practices

Geologic Sequestration

Requirements	Wyoming	Montana	North Dakota	Washington
UIC Primacy	Yes	No	No	Yes
Pore Space Owner	Surface Owner	Surface Owner	Surface Owner	State
Split Estate w/ Minerals	Mineral Estate Dominant – no injection in structures with HC	Equal Standing	Equal Standing	Equal Standing
Regulating Agency	DEQ/WOGCC	MBOG/DEQ/ DNRC	Industrial Commission/Health Department	WDOE
Unitization Requirement	75%	60%	60%	Not Defined
Fee Structure	Application Fee	per/T charge TBD	per/T charge TBD	Application Fee
Financial Responsibility	Surety Bond TBD	Surety Bond TBD	Surety Bond TBD	Financial Assurance Mechanism
Release of Liability to third party	UIC Requirement – No State Ownership	15	10	Determined post-closure and does not terminate with permit termination
Other constituents allowed in injection stream	Yes	Yes	Yes	No
Area of Review beyond predicted plume size	1 Mile	½ Mile	¼ Mile	10 Miles
Separate Process for Research Wells	Yes	No	Yes	Yes

State Primacy for the UIC Program

Requirements	Wyoming	Montana	North Dakota	Washington
UIC Primacy	Yes	No	No	Yes

- States can elect to accept primacy for the Underground Injection Control (UIC) Program of the Safe Drinking Water Act (SDWA).
- Montana's adoption of new CCS statutory authority is predicated on assumption of primacy from EPA and the statute is not valid until EPA grants primacy.
- WY, ND, and WA currently have primacy over the UIC program.

Pore Space Ownership

Requirements	Wyoming	Montana	North Dakota	Washington
Pore Space Owner	Surface Owner	Surface Owner	Surface Owner	State

- Many states that harbor significant subsurface mineral and/or oil and gas deposits create a “split estate” that separates the surface estate from the mineral estate.
- Within the subsurface there are pore spaces or voids that are not occupied by minerals or oil and gas and these spaces are statutorily assigned to the surface owner in WY, MT and ND independent of the mineral estate.
- WA does not define nor establish ownership of the pore space.

Dominance of Subsurface Ownership

Requirements	Wyoming	Montana	North Dakota	Washington
Split Estate w/ Minerals	Mineral Estate Dominant – no injection in structures with HC	Equal Standing	Equal Standing	Equal Standing

- Wyoming established dominance of the mineral estate over the pore space ownership. Geologic storage in the pore space is prohibited without the consent of the mineral estate owner. Geologic storage is prohibited in formations that contain commercial quantities of hydrocarbons. This does not apply to EOR operations.
- The other states all give equal standing to the mineral estate and the pore space owner and require that neither approach can interfere with the other.

Regulatory Agency

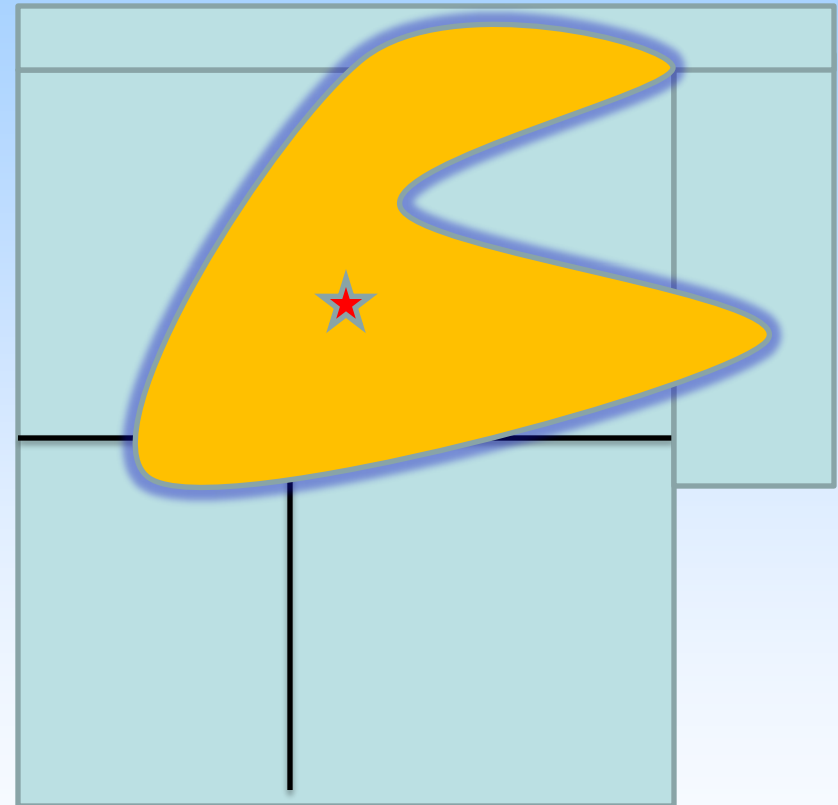
Requirements	Wyoming	Montana	North Dakota	Washington
Regulating Agency	DEQ/WOGCC	MBOG/DEQ/ DNRC	Industrial Commission/Health Department	WDOE

- For Wyoming and Montana, primary responsibility for geologic sequestration rests with the state environmental agency and the oil and gas agency. However, the environmental agency has a consultative role in MT and the oil and gas agency a consultative role in WY. ND has an arrangement similar to MT.
- The Washington Department of Ecology has sole responsibility for CCS activities in that state.

Unitization of Pore Space

Requirements	Wyoming	Montana	North Dakota	Washington
Unitization Requirement	75%	60%	60%	Not Defined

- During geologic sequestration, the plume may extend across several surface owners. To facilitate cooperation among surface owners, the storage reservoir can be “unitized” to establish volumes occupied for each surface owner for pricing purposes and to require some surface owners to cooperate with the injection even though they may object to the project. As noted in the table, each state (except WA) has determined that a majority (60-75%) of affected surface owners agreeing to the occupancy of the pore space will require adjoining affected landowners to cooperate as well. This approach is similar to eminent domain.



Fee Structure

Requirements	Wyoming	Montana	North Dakota	Washington
Fee Structure	Application Fee	per/ton charge TBD	per/ton charge TBD	Application Fee

- To protect the public from an operator that does not properly operate the site or abandons the site prior to closure, states have imposed a fee structure that places funds in a dedicated account to reimburse the state should the government have to assume responsibility for the site. This is done through application fees and annual operating fees, and through a per ton charge levied on each ton of CO₂ placed in the reservoir (MT and ND). The fees can also be used to administer the program and to monitor operations.

Financial Responsibility

Requirements	Wyoming	Montana	North Dakota	Washington
Financial Responsibility	Surety Bond TBD	Surety Bond TBD	Surety Bond TBD	Financial Assurance Mechanism

- Operators of geologic sequestration sites are required to maintain financial responsibility for the site, including any mitigation of leaks, contamination of ground water, etc, for the life of the injection and for a varying period of time post-closure of the site. All states accept a surety bond in an amount determined by the regulatory agency and Washington allows for other financial assurance instruments including letters of credit, cash, and liability insurance policies.

Release of Liability

Requirements	Wyoming	Montana	North Dakota	Washington
Release of Liability to third party	UIC Requirement – No State Ownership	30	10	Determined post-closure and does not terminate with permit termination

- Once injection ceases, each state requires a post injection monitoring period to ensure that the CO2 stabilizes and that no problems arise concerning containment of the gas.
- Wyoming follows UIC guidance for Class V wells and for proposed Class VI wells that would maintain responsibility for 50 years.
- Montana and ND assume responsibility for the site after 30 years and 10 years respectively. Federal preemption issues remain.
- Washington determines release of responsibility on a year to year basis subject to monitoring of the plume.

CO2 Purity

Requirements	Wyoming	Montana	North Dakota	Washington
Other constituents allowed in injection stream	Yes	Yes	Yes	No

- MT and ND require the injection stream to be of sufficient purity that it does not compromise the ability of the reservoir to store the injected CO2.
- Wyoming allows the injected stream to contain CO2 and “constituents.” Probably addressed via regulation.
- Washington does not allow any constituents in the stream for which there is a technology available for removing the constituent from the injection stream.

Area of Review

Requirements	Wyoming	Montana	North Dakota	Washington
Area of Review beyond predicted plume size	1 Mile	½ Mile	¼ Mile	10 Miles

- Once the areal extent of the storage reservoir has been determined, states vary in the additional area that must be characterized for abandoned wells, faults, active wells, etc (1/4 to 10 miles). These requirements also include notification of surface owners and mineral rights owners.
- Proposed UIC regulations may usurp state requirements since the area of review must include the plume and associated pressure front. State requirements can be more strict but not less strict than federal regulations.

Research Wells

Requirements	Wyoming	Montana	North Dakota	Washington
Separate Process for Research Wells	Yes	No	Yes	Yes

- To properly characterize a geologic sequestration site, it is often necessary to drill research wells involving the injection of small volumes of CO₂ to determine injectivity and capacity of the storage reservoir.
- WY, ND, and Washington have established regulatory provisions that allow much easier permitting processes for research wells. MT statutes currently have no such provision.

What else?

Public Acceptance

We should not attempt to achieve consensus, but rather, informed consent.

We should be open about the opportunities and the risks.

We should acknowledge the uncertainty surrounding regulatory and policy frameworks.

We should be honest about the costs.

We should be promoting CCS as a temporary, not a permanent solution.

“There are no solutions, only tradeoffs.”

Questions, Comments and Discussion