GEOLOGIC HAZARDS & CO_2 STORAGE RISK

OVERVIEW

Geologic CO_2 storage projects are designed to safely contain CO_2 deep underground for thousands of years. Before injection begins, sites are screened for natural hazards and subsurface risks, including:

- Fault zones and seismicity
- Legacy oil and gas wells
- Abnormal pressure conditions
- Caprock integrity
- Groundwater protection

Wyoming's geologic setting is generally favorable for storage, but risks vary by basin and must be evaluated site-by-site.

FAULTS ZONES & SEISMICITY

Wyoming contains both ancient and active fault systems.

What is the risk?

Faults can:

- Provide pathways for fluid movement
- Reactive under increased pressure
- Cause small earthquakes during injection

What does the data show?

- Most earthquakes in Wyoming are small (less than magnitude 4)
- No documented cases of induced seismicity from oil and gas operations in Wyoming
- Larger earthquakes unlikely to cause significant infrastructure damage.

How is it managed?

- Avoidance of critically stressed faults
- Pressure modeling before injection
- Step-rate injection testing
- Continuous seismic monitoring during operations
- Adaptive injection controls

LEAKAGE RISKS

CO_2 could theoretically migrate through:

- Fault zones
- Old oil and gas wells
- Up-dip movement along basin flanks

Basin-Specific Observations

Greater Green River Basin

- Elevated fault-related leakage risk near the Rock Springs Uplift
- Requires careful structural characterization

Powder River Basin

- Higher density of legacy oil and gas wells
- Well integrity screening is critical

Mitigation measures

- Area of Review (AOR) modeling
- Identification and remediation of legacy wells
- Multi-layer caprock evaluation
- Groundwater monitoring

ABNORMAL PRESSURE

Some Wyoming basins contain zones with higher- or lower-than-normal subsurface pressure.

Why this matters

If a reservoir is already over-pressured, additional injection could:

- Exceed caprock fracture pressure
- Re-open existing fractures
- Increase leakage risk

Abnormal pressure zones have been documented in:

- Hanna Basin
- Denver Basin
- Portions of the Powder River Basin

How is it managed?

- Pre-injection pressure testing
- Conservative injection limits
- Real-time pressure monitoring

RISK PRIORITIZATION

Based on published research, the most likely risks for CO_2 storage involve:

- Dissolution of carbonate minerals
- Re-opening of existing fractures
- Seal integrity uncertainties
- Unexpected fault behavior

The most severe (but less likely) risks include:

- Caprock fracturing
- Reactivation of or creation of new faults
- Induced seismic events greater than magnitude 4
- Unexpected high pressures

KEY TAKEAWAYS

- ✓ Wyoming has relatively low natural seismicity.
- ✓ Most identified risks are manageable through site selection and monitoring.
- ✓ Legacy wells represent a higher risk in hydrocarbon-producing basins.
- ✓ Pressure management is central to safe storage.
- ✓ Class VI regulations require extensive modeling and monitoring.