Working Group #4
Underground Gas Storage

Leaders: Ray Harris
CJ Osman

Facilitator: Steve Nanney
Kenneth Lee

Attendance Breakdown

Approximate total attendance	50 persons
Federal Regulators	3 persons
Storage Operators	20 persons
Storage Service Providers	10 persons
Researchers	10 persons
Academics	2 persons
Other	5 persons

Summary of Key Gaps

- **Gap #1 –** (General Knowledge/Standards) **Risk Assessment and Treatment**
- **Gap #2 –** (General Knowledge/Technology) **Evaluation of Well Casing Strength**
- **Gap #3 –** (Standards /Technology) **Cement as a Barrier**
- **Gap #4 –** (Standards /Technology) **Well Construction Barriers**
- **Gap #5 –** (General Knowledge/Standards/Technology) **Subsurface Safety Valves**
- **Gap #6 –** (Standards /Technology) **Monitoring Equipment**

Risk Assessment and Treatment
(Gap #1)

1. *Creation and Dissemination of General Knowledge*

a. Understand well entry impacts
b. Leverage pipeline risk assessment methodologies

2. *New or Revised Consensus Standards (standards, guidelines or recommend practices)*

a. Develop relative, quantitative, and probabilistic risk assessment guidelines
    i. Consider consequence areas: location, pressure, volume, etc.
    ii. Extension of RP 1170/1171
b. Identify considerations for field/well-specific assessment
c. Build methodology for “roll-up” of individual assessments

Evaluation of Well Casing Strength
(Gap #2)

1. *Creation and Dissemination of General Knowledge*

a. "Synthesis Study" examining 100+ existing underground storage papers (PRCI, GTI, others)
b. API Burst Pressure, Barlow, RSTRENG, B31G, MB31G
c. Develop "R&D" Roadmap
d. Develop framework for feeding data into risk assessment

2. *New or Improved Technology*

a. Corrosion Logging: Leverage pipeline ILI technologies, different size capabilities
b. Validate Casing Properties downhole: Weight/Grade
c. Patching and Composites
d. Evaluation of multiple strings

Cement As a Barrier
(Gap #3)

1. *New or Revised Consensus Standards (standards, guidelines or recommend practices)*

a. Definition of Micro Annulus & Leak Paths*
b. Height of Cement required for isolation
c. Remediation

2. *New or Improved Technology*

a. Alternative materials
b. Evaluation technology

Well Construction Barriers
(Gap #4)

1. *New or Revised Consensus Standards (standards, guidelines or recommend practices)*

a. Guidelines for new wells vs. existing wells
b. Tubing and packer life cycle analysis
c. Understand well entry impacts

2. *New or Improved Technology*

a. Tubing coatings
b. Alternative packers/installations

Subsurface Safety Valves
(Gap #5)

1. *Creation and Dissemination of General Knowledge*
a. Quantify reliability
b. Develop evaluation criteria (e.g., allowable leakage/failure)
c. Quantify deliverability effect
d. Understand well entry impacts

2. *New or Revised Consensus Standards (standards, guidelines or recommend practices)*
a. Shallow set vs. Deep set

3. *New or Improved Technology*
a. Design Improvements for enhanced reliability in gas environment
b. Alternative shutoff technologies

Monitoring Equipment
(Gap #6)

1. *New or Revised Consensus Standards (standards, guidelines or recommend practices)*

a. Guidelines for annular monitoring: frequency, localized vs. remote, etc.
b. Detection and Response guidelines

2. *New or Improved Technology*

a. Emergent technologies (e.g., fiber optics, downhole leak detection, something the porcupines won't eat)
b. Lower cost/higher reliability devices
c. Network design
d. Intelligent devices
e. Surface leak detection: improved volume quantification, spacing requirements