Advancing GS Projects Under a New Regulatory Regime

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GWPC UIC Meeting
January 24, 2012
Regulatory Background

- EPA initiated development of GS regulatory framework
  - Technical Workshops on GS – 2005 – 2008
  - Stakeholder workshops 2007 – 2008
- Guidance 83 issued in the midst of this process to clarify permitting of experimental projects under UIC Class V
- Class VI regulations were proposed in 2008 and finalized in December 2010
- Based on the publications in this process, R&D project developers expected to have continued Class V permitting for RCSP Phase II, Phase III and similar projects
Technology Status

- EPA developed a regulatory framework for permitting of geologic sequestration (GS) wells – final rules in December 2010
- May 2011 multi-stakeholder discussion (MSD) participants identified specific concerns over potential hurdles in the final rules
- Today no completed commercial CCUS projects in U.S.
- Numerous pilot and demonstration scale projects
- Issues have surfaced regarding the proper permitting steps for pilot and other demonstration scale projects
Demonstration Projects

- Demonstration projects provide valuable information regarding the suitability of different geologic settings, project designs, and technological methods.
- Larger than pilot projects but smaller amounts of injection and shorter time durations than commercial scale projects.
- Face many of the same requirements for planning, provision of site information, financial assurance and post-injection site care as commercial projects.
- Unless reasonable solutions can be devised to satisfy the new regulatory requirements while preserving the core scientific and technical elements of each demonstration project, regulatory and permitting issues may impose additional hurdles to completing the RCSP projects as originally designed and for enabling future experimental projects.
Regulatory Background

- EPA initiated development of GS regulatory framework
  - Technology workshops 2005 – 2008
  - Stakeholder workshops 2007 – 2008
- Guidance 83 issued in the midst of this process to clarify permitting of experimental projects under UIC Class V
- EPA then accelerated development of regulatory framework for commercial GS
- Class VI regulations were proposed in 2008 and finalized in December 2010
- Based on various publications during this rulemaking process, RD&D project developers expected to have continued Class V permitting for RCSP Phase II, Phase III and similar projects
GS Preamble Appeared to Reaffirm Class V for Experimental Projects

“EPA has determined that the Class V experimental technology well subclass provides the best mechanism for authorizing pilot GS projects.”

UIC Guidance 83 at 5-6 (2007)

Following promulgation of today’s rule, . . . GS projects of an experimental nature (i.e., to test GS technologies and collect data) will continue to be classified, permitted, and regulated as Class V experimental technology wells; . . . .

75 Fed. Reg. at 77245 (Dec 10, 2010)

Today’s rule, at § 146.81(c), requires owners or operators of Class V experimental technology wells no longer being used for experimental purposes (e.g., wells that will continue injection of CO2 for the purpose of GS) to apply for Class VI permits within one year of rule promulgation and to comply with the requirements of today’s rule.

75 Fed. Reg. at 77245
Class V Approach Consistent with Fundamental Policy Considerations for Experimental Technologies

The justification for treating this type of experimental well as Class V is that, to encourage innovation, a developing technology arguably should not be burdened by strict technical standards designed for commercially operating facilities.

GWRG 28 ETW Guidance at 2 (1983)

While flexibility is important, the Safe Drinking Water Act (SDWA) focuses on the protection of USDWs and public health, and no project should be designed or operated in a way that endangers USDWs or the health of persons.

UIC Guidance 83 at 3 (2007)

In addition, many of these new technologies are closely monitored by other federal agencies to collect information on and guard against threats to drinking water.

GWRG 28 ETW Guidance at 3 (1983)
Pilot Scale Projects

- Shorter time periods (e.g., Frio Project lasted 10 days)
- Smaller volumes (1,000 to 30,000 tons)
- Trucking food grade carbon dioxide
- Major reasons for Class VI rule were pressure effects and size of injection – not present for pilot projects
- Class V should still be available for experimental technology wells
Small Scale Concerns

How long to obtain Class VI permits
- Early estimates indicate 18 months
- Need more streamlined process

Post injection site care timeframe
- Default period of 50 years inappropriate
- Difficult to demonstrate alternative timeframe

Financial assurance demonstration

Long term liability presumptions for short term projects
Field Data Collection

- Class VI application very dependent on modeling
- Significant data requirements for modeling
- Need data on both one phase and two phase flow in the injection zone
- Need field validation of the relative permeability
- Requires injection of CO2
- EPA indicates CO2 injection cannot be done without first obtaining the permit
Need Two-Phased Permitting

Some projects collect data through a stratigraphic test well permitted by O&G agency.

This is good for coring and collecting some geologic data but cannot provide all of the data for a Class VI permit application.

There is a need for more comprehensive two-phased authorization process.
PISC Requirements

- DOE originally planned 2 years post-injection monitoring at each site
- Project timelines created expectations
- Recognition that longer PISC periods will be required in many cases
- Need to scale PISC to project parameters and data collection
Alternative PISC Timeframe

Operators should be allowed to make a demonstration supporting approval of an alternative post-injection site care (PISC) period shorter than the 50-year default period.

This option should be open throughout the lifetime of a GS project so that an operator will be encouraged and able to use current monitoring and operational data and experience to support and periodically improve such a demonstration.

To be effective and to provide incentives for the best possible understanding and projections of GS project performance, these demonstrations must be allowed at every stage of the project.
Why the concern?

Concern arises from the use of the words “during the permitting process” in section 146.93(c) of the final rule, the statement in the preamble to the final rule that “[t]his demonstration must be submitted as part of the permit application pursuant to § 146.82(a)(18)” (75 Fed. Reg. at 77267) and from presentations by EPA officials following promulgation of the rule stating that this demonstration must be made “at the time of permitting.”

Considered together, these statements appear to indicate that there is only a one-time opportunity to make such a demonstration in the original permit application and not at any later time.

Because Class VI permits are effective for the life of the project, the “permitting process” is arguably completed once the permit is issued.
EPA’s Draft Primacy Manual recognizes that the alternative timeframe demonstration is one of the items to be reviewed and potentially revised following the preliminary testing and related data gathering conducted in conjunction with the drilling and construction of Class VI wells. Similar revisions should be allowed at later stages as well. By making these revisions under §146.93(a)(3), modifications of the alternative PISC timeframe will be completed “during the permitting process” consistent with the regulatory language of 146.93(c). The term “during the permitting process” should include not only the demonstration submitted at the initial permit application and well operation authorization stage but also any subsequent permit modification proceedings to incorporate plan revisions to the PISC, including the alternative timeframe.

Maximum Monitoring Area

- The assumption is that the Subpart RR MMA will be smaller than the UIC Class VI area of review (AoR) in almost all cases.
- MMA is primarily intended to be a long-range planning tool used to determine where the owner or operator of a GS project will conduct the assessment to identify all potential surface leakage pathways that might need to be addressed through the Monitoring, Reporting and Verification (MRV) plan.
- A buffer zone was included to recognize that leakage pathways might not be directly vertical and should be considered when extending outside of the area directly above the CO2 plume.
- EPA clarified that the MRV plan should be site-specific and should provide for the consideration of monitoring and methodologies that address potential surface leakage pathways.
Annulus Pressure Operation

The MSD group had agreed and recommended that the annulus pressure need not exceed the injection pressure as long as there is a positive annulus pressure maintained to ensure that a leak could be detected during monitoring.

The main concern with maintaining an annulus pressure that is higher than the injection pressure is that bottomhole pressures can become excessive at great depths and higher annulus pressure requirements can exacerbate this problem by increasing the potential for damage to packers and other well components, primarily the casing itself.

EPA adopted a final rule that allows the Director to approve the maintenance of an annulus pressure that is not greater than the injection pressure where “such requirement might harm the integrity of the well or endanger USDWs.”
Long String Casing Requirements

The MSD recommended recognition in the rule that there are times when it is impossible to achieve a complete cement sleeve around the long string casing from the injection zone to the surface.

The MSD recommendation would have allowed the Director to “approve the use of packers or alternative isolation techniques, provided these are demonstrated to be equivalent to cement or more effective to provide adequate isolation and to protect USDWs”.

Under section 146.86(b)(3), it is unclear that the Director would have the ability to approve a well with a gap in the cement even with the use of acceptable alternatives to achieve the necessary isolation.
Alternative Cementing

Clarification is that section 146.86(b)(4) addresses this issue, by providing that “[t]he Director may approve an alternative method of cementing in cases where the cement cannot be recirculated to the surface, provided the owner or operator can demonstrate by using logs that the cement does not allow fluid movement behind the well bore.”

This would specifically allow a Director to approve cementing in stages to mitigate risk and challenges posed by alternative cementing methods.

EPA will consider further clarifying this issue in the guidance document for well construction, possibly using some of the language provided in the MSD group comments and recommendations.
Post-Injection Stabilization

Subpart RR uses the term “stabilization” which was dropped from the Class VI rule.

Discussion has confirmed that this term was not intended to modify the discontinuation of Subpart RR reporting requirement of “demonstration that current monitoring and model(s) show that the injected CO2 stream is not expected to migrate in the future in a manner likely to result in surface leakage.”
The MSD participants recommended requirements for logging, testing and monitoring that avoided prescribing specific logs, tests, and monitoring methods by focusing on what must be demonstrated rather than what technique must be used.

EPA has confirmed that this is the intent of the final rule. The provision for “[a]ny alternative methods that provide equivalent or better information and that are required by and/or approved of by the Director” in section 146.87(a)(5) allows the Director to approve newer methods that are developed or alternative means for providing the information considered necessary by the Director.

Section 146.89(e) also provides that “[t]he Director may require any other test to evaluate mechanical integrity under paragraphs (a)(1) or (a)(2) of this section” which effectively allows the Director to adopt or allow newer methods or alternative MIT procedures.
Pressure Front

Concerns over the definition of pressure front have already been allayed in the Draft UIC Program Class VI Well Area of Review Evaluation and Corrective Action Guidance.

By stating that “[t]he pressure front, as described below, is the extent of pressure increase of sufficient magnitude to force fluids from the injection zone into the formation matrix of a USDW through a hypothetical open conduit” (at page 32), the draft Guidance recognizes that the fluid movement to be considered is the potential vertical movement “through a hypothetical conduit”.

This should be retained in the final guidance
The definitions of both “injection zone” and “confining zone” refer to a "geologic formation, group of formations, or part of a formation".

In light of these definitions, the definition of “Transmissive fault or fracture”, working in combination with the section 146.83(a)(2) siting requirement that a confining zone must be “free of transmissive faults or fractures” might conceivably disqualify a confining zone that has faults or fractures that are transmissive as between formations fully contained within a group of formations comprising the confining zone but that do not provide any transmissivity that would allow movement out of the confining zone.

To avoid that interpretation, the MSD recommendation called for inclusion of the phrase “allow fluids to move beyond a confining zone” rather than “allow fluids to move between formations”.

EPA has confirmed that there was no intent to exclude confining zones that did not have transmissive faults or fractures that would allow movement out of the confining zone.
Challenges of Coordinating Demonstration Scale Projects with Commercial GS Regulations

- Demonstrating experimental nature
- Applying appropriate technological standards given experimentation
- Optimizing and coordinating learning opportunities
- Incentivizing experimentation to inform future GS regulations
- Ensuring permits address all necessary regulatory considerations
- Minimizing regulatory compliance burdens
- Identifying appropriate PISC timeframes and requirements
- Financial assurance
- Defining and bounding project operator commitments
- Testing failure and mitigation modes without endangering USDWs or human health
For More Information

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