UIC Class VI Permit Refinements

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Disclaimer

The information I am presenting today is a collection of ideas that have been put forth as potential improvements for the Class VI regulations and permitting process. I present them as a reporter rather than as an advocate. The views I am presenting are my personal views and are not presented on behalf of the Carbon Sequestration Council, the law firm with which I am affiliated (Bryan Cave Leighton Paisner LLP) or any other organization with which I have a relationship.

Sources

Ideas presented here have come from:

- Presentations, papers and reports by people involved in seeking Class VI permits
- DOE and the Regional Carbon Sequestration Partnership (RCSP) Initiative as well as the Best Practice Manuals (BPMs) for geologic storage projects
- Recommendations of the multi-stakeholder discussion (MSD) group of environmental NGOs, industry, and regulators with which I worked in 2008-2010 when those coincide with other ideas presented

Timeliness

- EPA published Class VI regulations on December 10, 2010
- EPA explained the need for and merits of using "an adaptive approach" to regulating for Geologic Storage (GS)
- The Agency indicated that this approach would:
  - provide near term regulatory certainty,
  - promote consistent permitting approaches, and
  - ensure that Class VI permitting Agencies are able to meet current and future demand for Class VI permits.
- EPA also committed every 6 years to "evaluate ongoing research and demonstration projects and gather other relevant information as needed to make refinements."

Demand for Class VI permits

- EPA undoubtedly anticipated greater demand for Class VI permits than has been the case, but this will change
- Four facilities actively engaged in the Class VI permitting process beginning in 2011
  - Archer Daniels Midland (ADM) obtained 2 permits
  - FutureGen Industrial Alliance obtained 4 permits
  - KGS/Borexo for the Wellington Small Scale Carbon Storage Project
  - Big Sky RCSP for the Kevin Dome project
- Six permits have issued but only 2 Class VI wells exist

Experience Suggests Refinements

- Revisions to the regulations
- Changes in interpretation of regulations or in policies for implementing the existing regulations
- Modifications in permitting process

Class VI Permitting to Date: Challenging and Educational

- Challenging for EPA
  - Finalizing the regulations and responding to comments
  - Developing 13 guidance documents covering all aspects of the permitting process
  - Developing procedures and expertise for reviewing permit applications and the related demonstrations using computational modeling, risk assessments, monitoring and testing strategies, and other materials
- Challenging for permit applicants and their resources
  - Delays in reviewing permits while developing the process
  - Changes in the types of information requested and how it should be presented
  - Having to redo computational modeling and technical demonstrations

Permitting for Pilot and Demonstration Projects

- Experience has shown difficulties for pilot and demonstration scale projects to get the Class VI permits being required by EPA for all CO2 injection
- Most problems relate to scaling Class VI provisions to fit much smaller projects when clearly designed for commercial projects
- Problem areas include:
  - Rescaling project plans from decades to years
  - Meeting financial assurance requirements
  - Demonstrations to support alternative PISC timeframe

Two Alternative Approaches

1. Allow the use of Class V experimental technology permitting for CCUS pilot and demonstration projects.
   - Does not require revisions to the regulations because EPA and primacy states administering the Class V UIC program currently have the authority to decide when a project is experimental
   - Decision should focus on the main purpose and scope of the project which should be directed at further development of the technology rather than geologic sequestration of CO_2
2. Alternatively, Class VI regulations should be applied adaptively to allow greater scaling of permit conditions to fit the intended size and purpose of projects, while still providing sufficient protection of USDWs.

Risk-Based Management

- UIC Class VI program does not fully allow for risk-based management for GS projects
- Problem precedes Class VI and stems from EPA decision to impose a no fluid movement prohibition for underground sources of drinking water (USDWs) regardless of any potential health risks
- Although there are sound arguments for an alternative interpretation of its regulations, EPA has chosen an approach that requires rulemaking to change

Endangerment of Underground Sources of Drinking Water (USDWs)

- Safe Drinking Water Act endangerment is risk based
- Endangerment of a USDW occurs when injection results in the presence of contaminants that may:
  - cause a public water system's "not complying with any national primary drinking water regulation" or
  - "otherwise adversely affect the health of persons."

42 USC §300h-1(d)(2)

- EPA has stated, and a court has concurred, that this statutory standard is inherently linked to assessment and management of risk
- Yet the Class VI regulations prevent even inconsequential movement of fluids into a USDW

Allowing NRAP Applications

- DOE's National Risk Assessment Partnership (NRAP) is developing approaches and tools for integrated, science-based, and site-specific risk modeling for long-term storage of CO_2 (especially with respect to potential aquifer impacts).
- Benefits from that work will be less useful if Class VI permit requirements do not allow risk-based management to prevent endangerment of USDWs.
- EPA could revise its regulations to apply the risk-based standard of endangerment defined by the SDWA.

Financial Responsibility

- Class VI requires a detailed written estimate, in current dollars, of the cost of:
  - performing corrective action on wells in the area of review,
  - plugging the injection well(s),
  - post-injection site care and site closure, and
  - emergency and remedial response.
- This should involve risk identification, assessment and management as a foundation for cost estimation
- Applicants report that EPA has imposed fairly rigid requirements for including estimates for remediating a USDW, costs of up to $60 million, regardless of project size
- The recommendations are for a more realistic approach to risk management and remedial cost estimation

Computational Modeling

- Computational modeling is a major component of the permitting process
- EPA decided not to prescribe models, allowing proprietary models. 75 Fed. Reg. 77249 (2010).
- EPA did not commit to duplicating modeling and has defended this approach 16 E.A.D. 717 (2015) .
- Yet permit applicants report EPA is trying to replicate the modeling and even requiring applicants to redo modeling using EPA's preferred model
- This approach has caused unexpected additional resource expenditures and time delays

Comprehensive Project Permitting Recommendations

- Allow the issuance of area permits under Class VI, using a single permit for multiple wells
- Give Class VI permit applicants the option of using project-wide plans for projects with multiple injection wells rather than being required to have a plan for each specific well
- Allow Class VI permit applicants to delineate an area of review for the entire project where multiple injection wells will be operated

Well Construction

- Modify the requirement that casing be cemented from total setting depth back to surface where unnecessary to achieve effective seals or to facilitate future operation and closure of the wells
- The regulations could be revised to accept the multi-stakeholder consensus recommendation:

> At least one long string casing, using a sufficient number of centralizers, which at a minimum: must be sealed from within the injection zone upward through the overlying confining zone, and must provide adequate isolation of the injection zone and other intervals as necessary for protection of USDWs using cement and/or other isolation techniques. The Director may 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.

Eliminate 50-year PISC Default

- Current requirement presents a huge challenge and is reportedly a roadblock to project financing
- Experience with industrial injections of CO_2 and other fluids has demonstrated that well-characterized and well-chosen sites have low risk and can be closed much sooner.
- EPA's final rule modified the 50-year PISC requirement to allow more or less time based on demonstrating nonendangerment.
- Detailed computational modeling and technical demonstrations are now required to support an alternative PISC timeframe.
- Same approach could support a "proposed" PISC timeframe.
- This would also allow a more adaptive approach for smaller research projects.

Allow Designation of Exempted Aquifers

- For all other UIC well classes, a Director may designate "exempted aquifers" using the criteria in 40 CFR § 146.4.
- Such aquifers are those which would otherwise qualify as "underground sources of drinking water", but which have no real potential to be used as drinking water sources and therefore are not USDWs.

40 CFR § 144.1(g)

- Several projects have been precluded from obtaining Class VI permits in part because of the inability to use such designations

Monitoring

- Class VI requires tracking the injected CO_2.
- Currently a demonstration cannot be made to eliminate the requirement to track CO_2 based on a geological assessment or site performance data.
- Class VI monitoring should allow containment monitoring of the injected CO_2 rather than requiring monitoring to show the exact location of CO_2 injected.

Injection zone monitoring

- Do not require mandatory use of monitoring wells drilled into the injection zone, allowing any direct testing and monitoring to track the extent of the CO_2 plume and elevated pressure to be conducted through the injection wells (e.g., pressure falloff testing).
- This is important to avoid requiring unnecessary penetrations of the injection zone that would immediately create the most likely leakage pathways.
- This could be accomplished by interpreting 146.90(g)(1) to allow this approach.
- Otherwise, a revision to the regulations would be required.

Closure Clarification

- Some EPA documents suggest that closing a CO_2 storage site requires demonstrating CO_2 plume is stable (i.e., immobile, or not moving).
- Class VI regulation states in Section 146.93 that closure can occur when it can be demonstrated that "the geologic sequestration project no longer poses an endangerment to USDWs" inherently recognizing that a CO_2 plume could continue to move without threatening any USDWs.
- EPA Class VI documents and supporting materials should consistently reflect actual regulatory language.

Permit Shield

- Section 40 CFR 144.35(a) states that compliance with a Class VI permit during its term constitutes compliance with Part C of the Safe Drinking Water Act.
- Yet generic language included in the initial Class VI permits requires compliance with regulatory provisions in addition to conditions of the Class VI permit.
- These conditions create uncertainty as to whether meeting the terms of the permit and fully complying with approved project plans alone will be acceptable.
- Permits should not leave open the potential that a project would also have to meet unanticipated additional requirements solely because interpretations change.

Maximum Injection Pressure

- Change the maximum injection pressure to require that pressures at the interface of the injection zone and confining zone not exceed the entry pressure of the confining zone.
- The emphasis should be on maintaining the integrity of the confining zone. The current requirement not to exceed 90% of fracture gradient is unnecessarily restrictive for injection zones with baffles as the highest pressure is at the injection well, and typically the pressure is increased at the injection well as part of a stimulation plan to enhance injectivity.
- Alternatively, adopt the multi-stakeholder recommendation:

> The owner or operator must comply with a maximum injection pressure limit approved by the Director and specified in the permit. In approving a maximum injection pressure limit, the Director shall consider the results of well tests and, where appropriate, geomechanical or other studies that assess the risks of tensile failure and shear failure. The Director shall approve limits that, with a reasonable degree of certainty, will avoid initiation or propagation of fractures in the confining zone or cause otherwise non-transmissive faults transecting the confining zone to become transmissive. In no case may injection pressure cause movement of injection or formation fluids in a manner prohibited by 40 CFR Part 144.12(a).

Improvements in Permit Process

- Do not require replication of the computational modeling used to delineate the area of review before granting a permit application.
- Delegate Class VI permitting fully to EPA regional offices and simplify permit application reviews to avoid delays in processing required to coordinate conference calls with multi-office and multi-personnel participation.
- Simplify the process of obtaining additional information needed for permit processing by allowing immediate communications. Do not save up requests for additional information (RAIs) and send long lists with short response times. Use a staged process to move through applications, reaching agreement on geology, for example, before proceeding to complex modeling exercises.

Summary of Changes Requiring Regulatory Revision

- Apply the SDWA standard for endangerment to Class VI so as to allow risk-based permitting, operation and monitoring
- Authorize designation of exempted aquifers using established criteria to allow GS in aquifers having < 10,000 ppm TDS that are not USDWs
- Authorize area permits and multiple well project plans to allow coordinated project management
- Eliminate the 50-year PISC period default
- Change the maximum injection pressure to require that pressures at the interface of the injection zone and confining zone not exceed the entry pressure of the confining zone.
- Allow modification of the requirement that casing be cemented from total setting depth back to surface where unnecessary to achieve effective seals or to facilitate future operation and closure of the wells.

Improvements Achievable with Policy Changes

- Greater use of Class V permitting for pilots and demonstrations
- Review computational modeling based on analyses and assessments of applicant-selected models rather than requiring reruns using EPA's preferred model
- Write Class VI permits consistent with the permit shield, allowing certainty in requirements
- Allow perimeter monitoring of GS reservoirs to provide CO_2 containment assurance rather than tracking the exact location of injected CO_2

Policy Improvements 2

- Do not require mandatory use of monitoring wells in the injection zone, allowing any direct testing and monitoring through the injection wells
- Allow designation of exempted aquifers regardless of whether the geologic formations at issue are being considered for inclusion in an injection zone
- Facilitate the use of risk-based and adaptive monitoring strategies that call for less monitoring (both frequency and type) as leakage risk decreases

Policy Improvements 3

- Ensure that documents accurately reflect the actual regulatory provision that closure can occur notwithstanding inconsequential natural fluid migration
- Continue improvements in communication and permit application processing to shorten the timeframes for resolution of technical issues.
- Allow risk assessment and risk management approaches to determine financial responsibility cost estimates, including consideration of subsurface geology, geochemical and geomechanical analyses in assessing risks.
- Allow greater flexibility to use financial responsibility estimates and instruments scaled to the project size.

Discussion