

# Reinvigorating Geologic Sequestration

Bob Van Voorhees  
Carbon Sequestration Council  
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# Permitting of CCS Projects

- General characteristics of successful permitting
  - Performance based regulatory framework requirements
  - Adaptable to site-specific and project-specific factors
  - Early and frequent communication and coordination between project owners and permitting authority
  - Early engagement with local and other stakeholders
  - Based on iterative development of operations and monitoring
  - Iterative development and modification of permit requirements
- Opportunities exist for improving the Class VI program
  - Increased flexibility for project siting
  - Better scaling of pilot and demonstration project permits
  - Administrative process improvements



# Improving Project Siting

- Project siting improvement requires lifting limitations on the siting of geologic sequestration (GS) projects
- Core requirement of the Safe Drinking Water Act (SDWA) UIC provisions is establishing and achieving “minimum requirements for effective programs to prevent underground injection which endangers drinking water sources”
- These minimum requirements and standards were established in the UIC program provisions but were truncated in the Class VI provisions



# Two-Step Identification Process

- The UIC regulations established a two-part process under which the term “underground source of drinking water” (USDW) is defined
  1. by using overly-inclusive criteria to identify aquifers that are potentially capable of producing water for drinking water use, and then
  2. by using the process for identifying exempted aquifers excluded from identification as USDWs because they have “no real potential to be used as drinking water sources.” 40 CFR § 144.1(g).

# Exempted Aquifers

- A UIC 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.
- **Therefore, they are not USDWs.**

40 CFR § 144.1(g)



# Separating Wheat from Chaff

- Identifying USDWs and exempted aquifers is intended as a separation rather than exclusionary process intended to identify the most appropriate use of aquifers.
- Identifying aquifers that are not USDWs is not by statute or regulation limited to formations intended to serve as injection zones.
- Designation of exempted aquifers should be available also for formations overlying and underlying intended injection zones.
- By foreclosing the completion of this process, UIC regulations promulgated for Class VI and other EPA policies prevent sensible application of legislative intent.



# Barring Fitting USDW Designations

- The UIC regulations provide in section 146.4 criteria by which “[a]n aquifer or a portion thereof which meets the [USDW] criteria . . . may be determined . . . to be an ‘exempted aquifer.’”
- But EPA precluded the application of those criteria for geologic storage by mandating in section 144.7 that “new aquifer exemptions shall not be issued for Class VI injection wells.”
- This unfortunate provision has already prevented the issuance of one Class VI permit for a very scientifically useful project developed by the Big Sky Carbon Sequestration Partnership (BSCSP).



# EG: BSCSP Kevin Dome Project

- Intended to demonstrate Kevin Dome as a viable and safe target for regional CO<sub>2</sub> geological storage (GS).
- Planned to extract CO<sub>2</sub> from the dome and pipe the CO<sub>2</sub> approximately 6 miles to the GS injection site.
- Potential additional step would have recovered injected CO<sub>2</sub> for use in enhanced oil recovery (EOR) or reinjection in Kevin Dome where initially produced.
- Project could not obtain Class VI permit for the GS well because the middle Duperow injection zone had <10,000 ppm TDS even though the zone also had high levels of hydrogen sulfide (H<sub>2</sub>S).
- If EPA had correctly allowed application of the exempted aquifer criteria, the Kevin Dome project could have pursued a Class VI permit for injection into an exempted aquifer that is not a USDW.

# Permitting Experimental Technology

After establishing a regulatory framework specifically for approval of CCS pilot and demonstration projects, EPA changed its approach without any significant forewarning and without adequate consideration or planning for the consequences of this change.



# Class V Permit for Kevin Dome

- EPA also blocked the scientific advances that would have been provided by the Kevin Dome project by refusing to consider granting a Class V experimental technology permit even though allowed by the rules.
- 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

# 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
- Additional requirements like Class VI requirements can still be applied “on a case-by-case basis” as “necessary to prevent the migration of fluids into underground sources of drinking water.”

# Class V Consistent with Fundamental Policy Considerations

- 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)

# Wellington Saline Aquifer Project

- 26,000 metric ton injection into underlying Lower Ordovician Arbuckle Group dolomitic saline aquifer
- Constructed well to Class VI requirements
- Submitted Class VI application, June 2014
- Had to identify mechanism and incur cost to meet financial assurance requirements for the Class VI permit
  - inject 26,000 tonnes of CO<sub>2</sub> (7 mo.)
  - one-year Post Injection Site Care (PISC) to closure.
- Forced to extend project beyond September 30, 2016 termination point in order to carry out Arbuckle injection.



# Class VI Permitting Process

- Demonstration on absence of USDW
  - Construct 3 shallow wells
  - Water quality testing
  - Analytical studies to demonstrate absence of USDW
- Address seismicity concerns
  - Installed Wellington seismic array
  - Opinion on induced seismicity in Kansas
  - Wellington seismic action plan
  - Site Structure and Induced Seismicity Report
- Responding to requests for additional information



# Small Scale Project Concerns

- How long to obtain Class VI permits
  - Early estimates indicated 18 months (1<sup>st</sup> Class VI took longer)
  - Need more streamlined process
- Post injection site care timeframe
  - Default period of 50 years inappropriate
  - Difficult to demonstrate alternative timeframe
- Financial assurance demonstration needs to be tailored
- Long term liability presumptions for short term projects

# Administrative Process Improvements

# Administrative Process Considerations

- Archer Daniels Midland Company Illinois Industrial Carbon Capture and Sequestration Project
  - Class VI permit application filed July 2011
  - Draft permit issued for public review and comment April 16, 2014
  - Permit issued September 23, 2014
  - Petition for review filed on October 28, 2014
  - Petition for review dismissed on November 26, 2014
  - Final permit issued December 1, 2014
  - ADM constructed and tested the permitted well during 2015
  - On November 8, 2016 EPA proposed permit modifications to address construction, logging and testing results following construction of the well
  - EPA issued final permit modifications on January 19, 2017
  - Petition for review filed February 7, 2017
  - Injection started April 7, 2017 almost 6 years after application



# FutureGen Alliance

- FutureGen Industrial Alliance
  - Draft permits issued for public review and comment April 1, 2014
  - Permits issued August 29, 2014
  - Petitions for review filed October 1, 2014 and halted activity
  - **DOE closeout of federal financial support February 2015 for inability to meet deadline to initiate construction**
  - Order denying review issued April 28, 2015
  - Judicial review dismissed as moot on February 23, 2016
- Petition for review was ultimately denied on all grounds
- Yet the delay caused by the appeal process was enough to contribute to the demise of the project



# Lessons

- Do not underestimate the novelty of CO<sub>2</sub> storage and ensure that regulatory stakeholders are effectively engaged early.
- Early engagement between project developers and regulatory authorities will promote efficiency and limit unnecessary expenses and delays.
- A parallel engagement approach to different regulators can reduce and improve the regulatory process.
- Build into regulatory frameworks the ability to learn from experience and make modifications to improve and expedite the process.



# Specific Recommendations

- EPA should reinstate the full process of identifying USDWs and exempted aquifers for Class VI geologic storage projects
- EPA should use Class V experimental project permitting for pilot and demonstration projects designed to explore unique aspects of the developing CCS technology rather than for full scale commercial storage operations
- Administrative procedures should be revamped to require that opponents of CCS projects demonstrate the need for staying permits during the review process, especially for modifications of permit provisions.
- Permits should always contain provisions allowing iterative revision of monitoring, testing and other requirements to adapt to increasing knowledge of technologies and projects.
- Permit revisions to substitute monitoring and testing methods the same parameters should not be considered substantial revisions.

# Questions?

# annex

The following slides provide additional information that may be useful to understand the content of this presentation.

# Endangerment of Underground Sources of Drinking Water (USDWs)

“Underground injection endangers drinking water sources if such injection may result in the presence in underground water which supplies or can reasonably be expected to supply any public water system of any contaminant, and if the presence of such contaminant may result in such system’s not complying with any national primary drinking water regulation or may otherwise adversely affect the health of persons.”

42 USC §300h-1(d)(2)



# Definition of USDW

An aquifer or its portion:

- (1)(i) Which supplies any public water system; or
- (ii) Which contains a sufficient quantity of ground water to supply a public water system; and
  - (A) Currently supplies drinking water for human consumption; or
  - (B) Contains fewer than 10,000 mg/l total dissolved solids; and
- (2) Which is not an exempted aquifer.

40 CFR §§144.3 & 146.3

# Exempted Aquifers

- A UIC 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.
- **Therefore, they are not USDWs.**
- No aquifer is an exempted aquifer until it has been affirmatively designated under § 144.7.
- Aquifers which do not fit the definition of “underground source of drinking water” are not “exempted aquifers.” They are simply not subject to the special protection afforded USDWs. 40 CFR § 144.1(g)



# Regulatory Background

- EPA's approach to identifying USDWs and exempted aquifers was promulgated in a 1980 rulemaking.
- EPA determined that without aquifer exemptions, certain beneficial uses of underground injection for energy production, solution mining, and waste disposal would be severely limited.
- EPA originally proposed a broad definition of covered underground waters with exceptions to allow such activities to continue.
- The original proposal would have required UIC program Directors to identify all USDWs to be protected from endangerment.
- The final rule presumed aquifers to be USDWs if they could produce water <10,000 ppm TDS sufficient to supply a PWS and changed the exceptions to criteria for exempted aquifers that are not USDWs.



# Unwarranted Regulatory Limit

- EPA never should have prohibited the designation of exempted aquifers in conjunction with GS projects.
  - EPA’s proposed GS regulations prohibited designation of exempted aquifers for GS.
  - Carbon Sequestration Council and others opposed this provision
  - EPA retained the prohibition, explaining incorrectly that “aquifer exemption removes the injection formation from SDWA protection as a USDW and allows injection (i.e., permitted or rule authorized) into an exempted formation.”
  - Instead, the designation of an exempted aquifer identifies a formation that is not a USDW.
- If EPA had correctly allowed application of the exempted aquifer criteria, the Kevin Dome project could have pursued a Class VI permit for injection into an exempted aquifer.

# 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 CO<sub>2</sub> 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