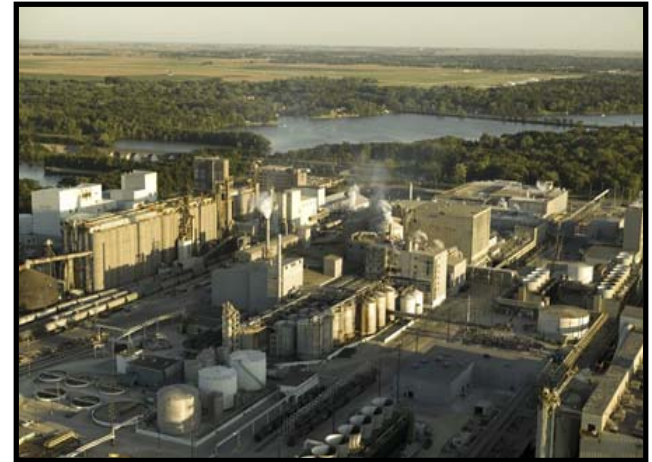


Permitting a CCS Injection Well within a Developing Regulatory Framework: The Illinois Basin – Decatur Site



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Underground Injection

- Safe Drinking Water Act (SDWA) passed in 1974
 - Protect public health by regulating Underground Sources of Drinking Water (USDWs)
 - USDW defined as $\leq 10,000$ mg/L total dissolved solids
 - Regulates underground injection
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Underground Injection Control (UIC)

- Five classes of injection wells defined:
 - Class I – Hazardous wastes, industrial non-hazardous liquids, or municipal wastewater below USDW (549)
 - Class II – Brines and fluids associated with oil and gas production (143,951)
 - Class III – Solution mining (18,505)
 - Class IV – Hazardous or radioactive waste above USDW – Banned (32)
 - Class V – Non-hazardous fluids above USDW, shallow on-site disposal, experimental (~400,000-650,000)

Class I



Class II



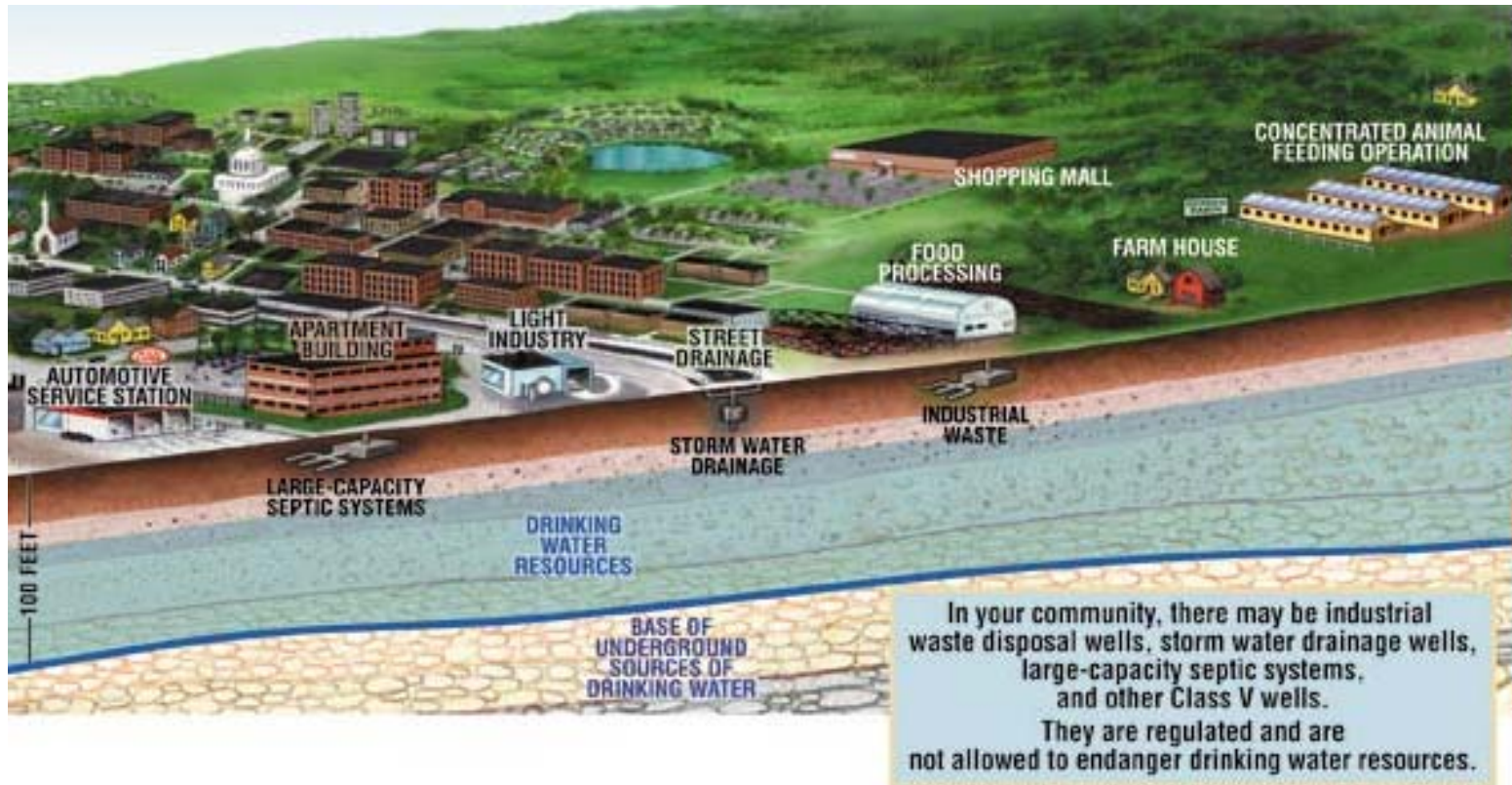
Class III



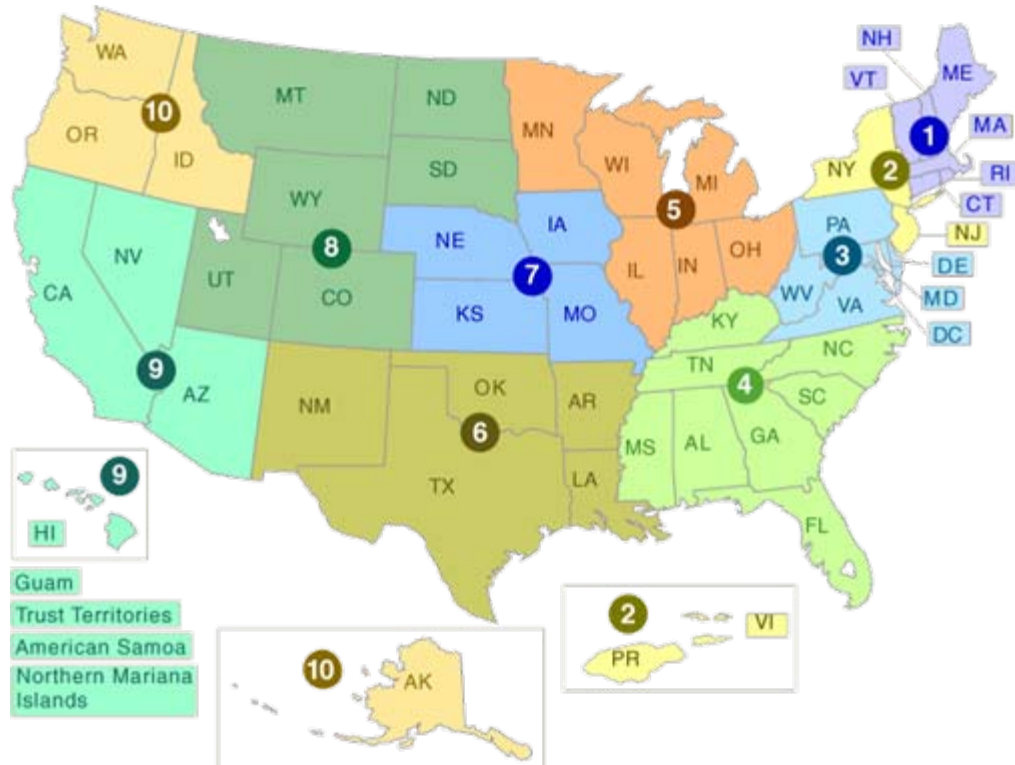
Class IV



Class V



US EPA Regions



Permitting a CCS Demonstration Project

- Corn processing plant
- CO₂ source is ethanol production facility
- Storage of 1 million tonnes CO₂ over three years
- One injection zone monitoring well
- Four regulatory shallow groundwater wells
- Area of review 2.5 miles





Regulatory Context

- Permit in emerging regulatory framework
 - Illinois (USEPA Region 5) has primacy: IEPA
 - UIC Class I, III, IV, V
 - UIC Class II through Illinois Department of Natural Resources – Mines and Minerals Oil and Gas Division
 - Most recent new permit for a Class I Non-Hazardous well was issued in 1970s
 - Shared common goal to see that projects were not slowed down by permitting process
 - Class V guidance for experimental wells issued
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Illinois Basin – Decatur Site Timeline UIC Class I Non-Hazardous

- 2007: Permit application started
- 2008: January - permit application submitted
February - first round technical clarifications
April - second round technical clarifications
July 15 - USEPA Class VI proposed rule available
July 17 - draft permit received for review
August - notice of public comment period and public hearing
September - information meeting, invited briefing, public hearing
October - final technical clarifications, public comment period closed
December 24, - permit issued
- 2009: January 27
February to May – drill injection well
July – Minor permit modification
October – Submit major permit modification
- 2010: Current – Awaiting response on major permit modification
Future – Major permit modification revisions & public process
- 2011: Expected injection
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Challenges

- Permitting a research demonstration project
 - Permitting in a changing regulatory environment
 - Permitting a site with no existing well bore
 - Permit modifications
 - Time and resources
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Balancing Research Goals and Regulatory Requirements

- MMV Program
 - Research monitoring wells
 - EPA required monitoring wells
 - Sampling
 - Frequency of reporting
 - Well Design (minimum requirements for regulations and injection)
 - Cementing
 - Casing size and length
 - Completion design
 - Perforated zones
 - Packer placement
 - In-zone monitoring wells
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Implications for Commercial Projects

- Build understanding of UIC program and permitting process
 - Early engagement with regulating agencies
 - Establish effective lines of communication
 - Streamline permit process
 - Prepare for risk of delays
 - Have specific CCS in-house or consulting permit expertise
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Permit Requirements

- Permit for 1 million metric tones CO₂ injection
 - Permit for project duration
 - Reapplication if use as commercial well, under new regulatory conditions
 - Well Construction
 - Casing – steel grades in application or better
 - Cement – CO₂ resistant cement
 - Surface, intermediate, and long-string cemented to surface
 - Operations – continuous recording of injection pressure, injection rate, temperature, annular space pressure
 - Closure – cement to surface
 - CO₂ Composition
 - As stated in permit application – 99.98%
 - Grab samples required annually
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Permit Requirements (cont.)

- Monitoring
 - 4 regulatory shallow groundwater monitoring wells
 - Determine lowermost USDW
 - Injection pressure to be determined (submitted in completion report)
 - Injection rate 1,200 tons/day
 - Corrosion plan (completion report)
 - Injection zone – demonstrate no cross contamination
 - Mechanical Integrity
 - MIT every 5 years
 - Annual annulus pressure test
 - Temperature survey every two years
 - Well annulus pressure – 400 psi minimum
 - Pressure differential – 100 psi differential between tubing and annulus during injection
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Technical Clarifications

- Round 1
 - Details (abbreviations, larger figures)
 - Cementing plan and specifications
 - Modification of verification well to injection well
 - Packer placement
 - Groundwater sampling and monitoring parameters
- Round 2
 - More detailed groundwater sample analysis plan
 - Annulus pressure maintenance
 - Multiple perforations
 - MIT of monitoring wells



Public Engagement

- Hosted Congressional Briefing
- Hosted Media Briefing
- Hosted Invited Briefing
- Hosted Public Information Meeting
- Working with Decatur Public Schools
- Public comment period closed October 17, 2008
- Comments from 3 sources, one major set from Sierra Club



The Public Hearing Experience

- Hearing opened
 - Brief summary of permit by IEPA
 - 12-15 members of the general public present
 - 1 local business owner concerned about groundwater
 - 1 NGO representative from Chicago regional office
 - Several curious parties
 - One satisfied customer... “I came here with questions, you answered my questions. I am satisfied.”
 - Opportunity to hear questions concerns
 - Few surprises
 - NGOs may employ delay tactics on projects
 - “We will be submitting several technical questions.”
 - No comments received by IEPA to date
 - Opportunity to help write technical responses to comments
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Questions/Comments

- Open for public comments/questions
 - What happens in the event of earthquakes?
 - How does this permit fit within new Class VI proposed rule?
 - How long is post-monitoring period for this well?
 - How long is permit issued for?
 - Who is liable if something goes wrong with the project?
 - Will the well materials be corrosion resistant?
 - Will the seismic data collected be available to the public?
 - Will Union rules be upheld?
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