

# **U.S. Experience in Permitting CO<sub>2</sub> Storage Activities**

*IEA and Global CCS Institute Joint Workshop  
Managing Long-term Liability for Geologic Storage of CO<sub>2</sub>  
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**Mary Rose (Molly) Bayer**  
*U.S. Environmental Protection Agency  
Office of Water: Underground Injection Control Program*



# Overview

- Underground Injection Control (UIC) Program Background
- Class VI Rule
- Class VI Permitting



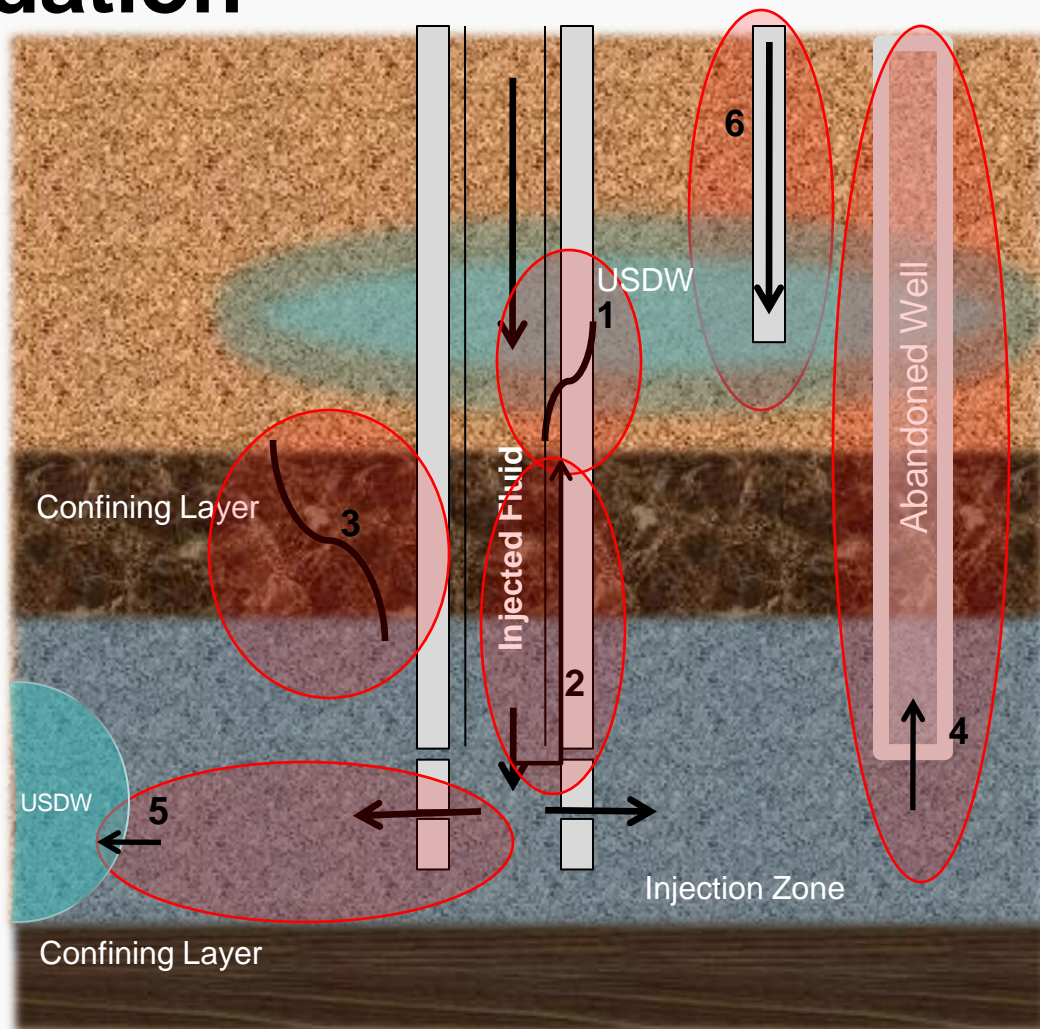
# Underground Injection Control (UIC) Program

- Under Safe Drinking Water Act Authority (1974; 1996)
  - Federal regulations for protection of Underground Sources of Drinking Water (USDWs)
    - USDW definition: Any aquifer or portion of an aquifer that contains water that is less than 10,000 PPM total dissolved solids or contains a volume of water such that it is a present, or viable future source to supply a Public Water System
  - Requirements for six well classes at 40 CFR 144 through 146
  - The UIC Program regulates underground injection of all fluids – liquid, gas, or slurry
    - Designation as a commodity does not change SDWA applicability
    - Natural gas (hydrocarbon) storage and some hydraulic fracturing fluids exempted; oil & gas *production* not regulated by the UIC Program
  - Injection is voluntary (i.e., under the UIC Program, there is no mandate to inject)

# UIC Program Foundation

## Potential Fluid Migration Pathways

1. Faulty injection well casing
2. Annulus between casing and the well bore
3. Migration through confining layers from injection zone
4. Vertical migration through improperly abandoned and completed wells
5. Lateral migration from within injection zone into a protected portion of USDW
6. Direct injection of fluids into or above a USDW





# Class VI Rule

## Considerations for GS

- Large Volumes
- Buoyancy
- Viscosity (Mobility)
- Corrosivity



## UIC Program Elements

- Site Characterization
- Area of Review (AoR)
- Well Construction
- Well Operation
- Site Testing & Monitoring
- Post-Injection Site Care
- Public Participation
- Financial Responsibility
- Site Closure

New well class established in 2010:  
Class VI



# Class VI Rule: Implementation

- Technical guidance development to support permit applicants, Class VI owners or operators, and co-regulators (i.e., States)
- GS Data Tool development to support electronic reporting, long-term data management, and ongoing data evaluation
- Coordination with:
  - EPA Program Offices and Regions, Federal partners and other stakeholders on CCS-related issues
  - States interested in implementing the Class VI Program
  - Class VI permit applicants and prospective applicants
    - Archer Daniels Midland: two injection well construction permits issued
    - The FutureGen Alliance: four injection well construction permits issued
    - Berexco/Kansas Geological Survey: permit application under review

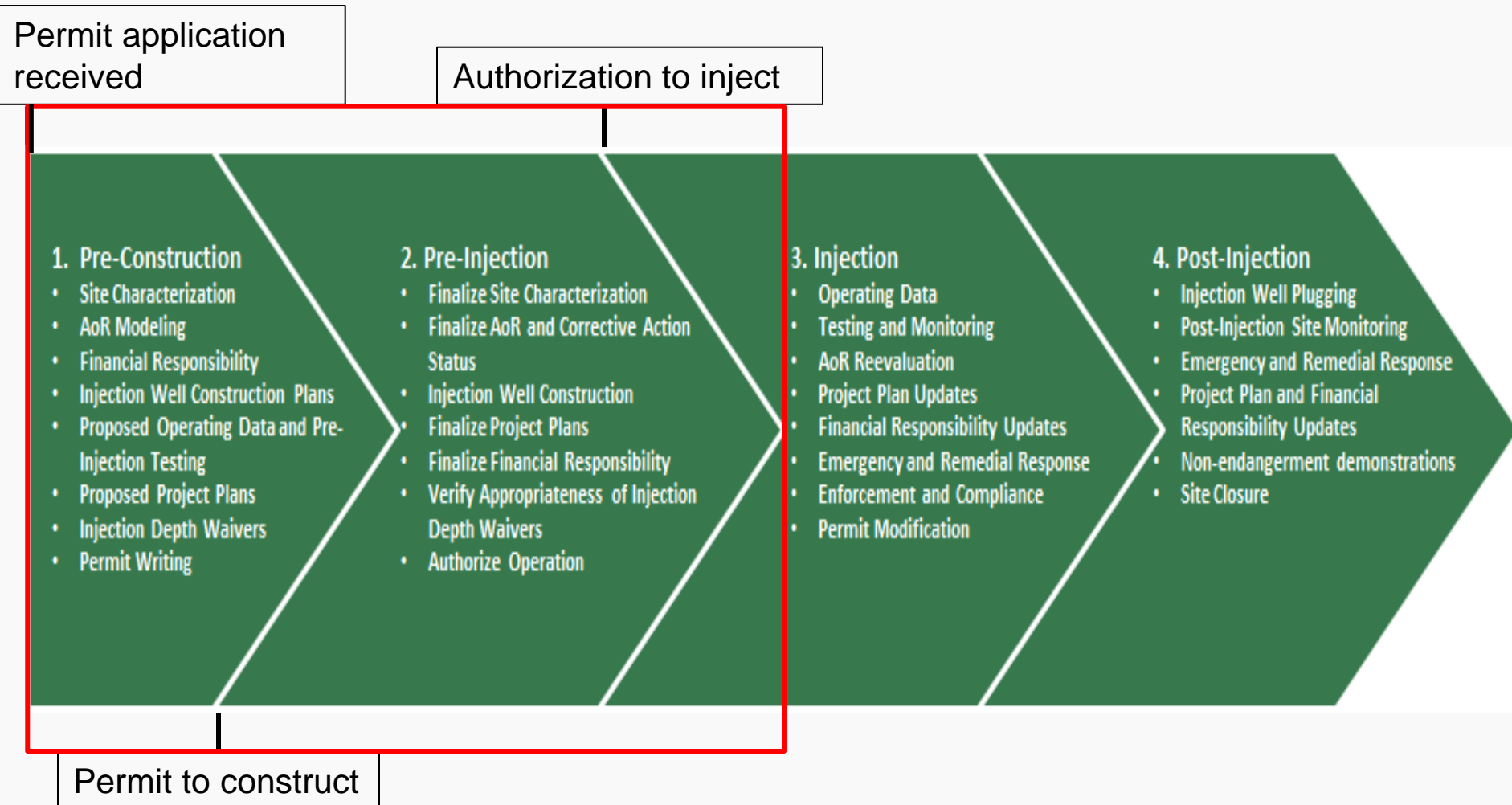


# Class VI Permitting: Goals and Responsibilities

- Comprehensively evaluate project information to:
  - Qualitatively and quantitatively understand geologic system behavior, uncertainties and sensitivities
  - Confirm that the geologic sequestration well or wells will be sited, operated, monitored and closed in a manner that ensures USDW protection
  - Ensure a complete, clear, science-based and defensible decision making process and documentation in the Administrative Record
  - Facilitate communication regarding EPA actions and decision-making with the permittee and the public



# Class VI Permitting: Process





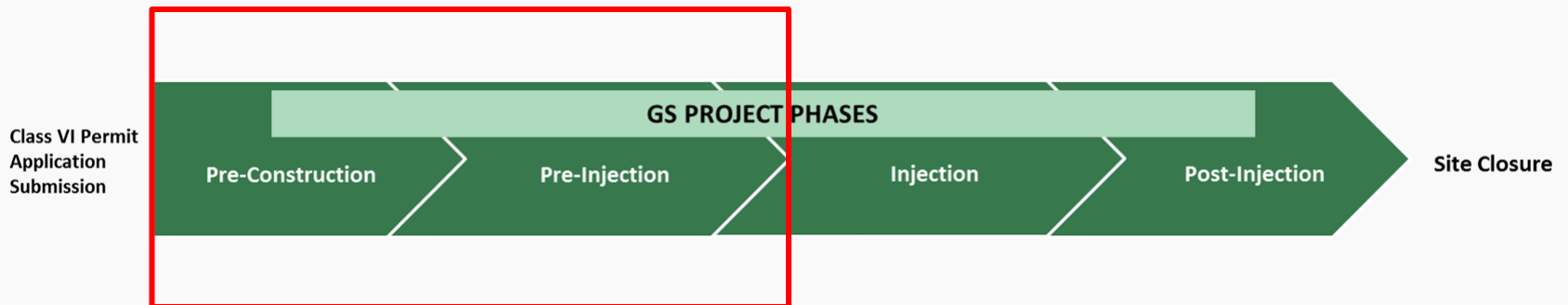


## Class VI Permitting: Evaluation

- Evaluate site-suitability (per 40 CFR 146.83)
- Review, inform and approve well construction/conversion and operating strategies
- Determine appropriateness of the AoR and corrective action approach
- Develop permit conditions
- Inform project planning (e.g., injection and post-injection testing and monitoring, emergency and remedial response)
- Identify and develop site-specific strategies to address data gaps, uncertainties, and risks for a given site/project



# Class VI Permitting: Evaluation





# Class VI Permit: Structure

- Permit (main body)
- Attachment A: Summary of Operating and Reporting
- Attachment B: Area of Review and Corrective Action Plan
- Attachment C: Testing and Monitoring Plan
- Attachment D: Well Plugging Plan
- Attachment E: Post-Injection Site Care and Site Closure Plan
- Attachment F: Emergency and Remedial Response Plan
- Attachment G: Construction Details
- Attachment H: Stimulation Program
- Attachment I: Financial Assurance



## **Class VI Permitting: Lessons Learned**

- Consistency, specificity, and certainty in submittals and communication are critical to successful permitting
- A multidisciplinary team approach leveraging expertise in relevant technical areas (e.g., geology, hydrogeology, modeling) is valuable to successfully develop and evaluate Class VI permit applications
- Ongoing research, technology development and risk assessment strategies will continue to inform regulatory decision making
- Continued support for and investment in education and training of the future workforce in CCS and GS technologies will be beneficial



## **Class VI Permitting: Lessons Learned (*cont.*)**

- Class VI Rule flexibilities exist to adapt projects moving forward (e.g., AoR reevaluations and the use of a phased approach to monitoring provide)
- Documenting early experiences in permitting is essential to support more efficient and effective Class VI permitting
- Use of EPA-developed tools and implementation resources is valuable to advancing permitting efforts



# Thank You!

[http://water.epa.gov/type/groundwater/uic/wells\\_sequestration.cfm](http://water.epa.gov/type/groundwater/uic/wells_sequestration.cfm)