Fifth Annual Conference on Carbon Capture & Sequestration

Steps Toward Deployment

Panel Session: The Need to Build Convincing Long Term Models of Carbon Sequestration in Geologic Reservoirs

The Role of Models in No Migration Petitions and Application to Geologic Sequestration of CO_2

Susie Lopez
EPA Region 6

May 8-11, 2006 • Hilton Alexandria Mark Center • Alexandria, Virginia

Acknowledgements

Ken Johnson - EPA Region 6

Brian Graves - EPA Region 6

Philip Dellinger - EPA Region 6

Anhar Karimjee - EPA HQ

Bruce Kobelski - EPA HQ

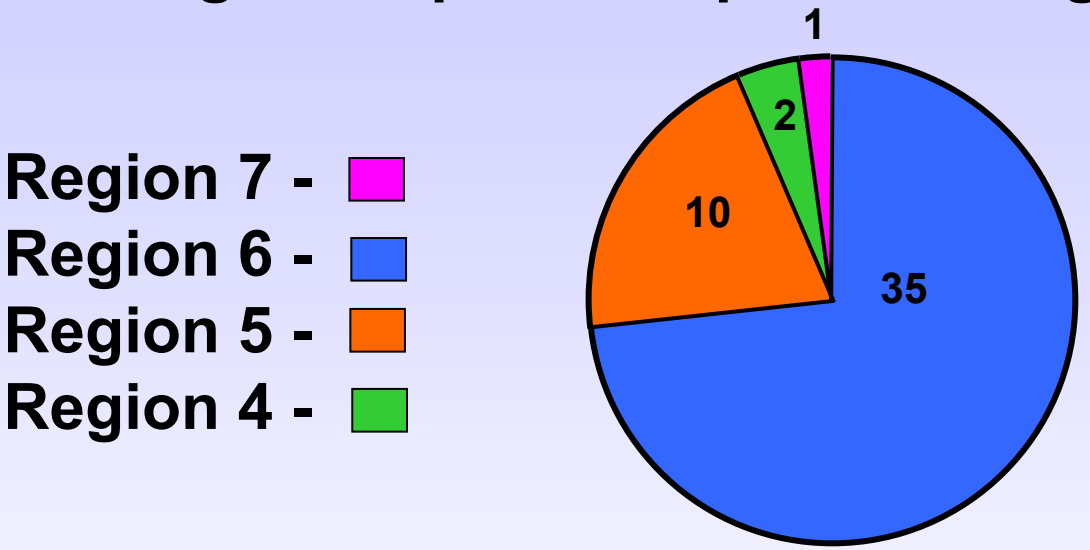
WARNING

Disclaimer: These slides and the information contained in them have been prepared by EPA staff for informational purposes only.

- **They should not be relied on for regulatory compliance purposes and do not necessarily reflect EPA's official policy and legal positions.**
- **To the extent any information in these slides is inconsistent with the statutes and regulations identified herein, the statutes and regulations themselves control.**

Introduction

Active no migration petitions per EPA Region



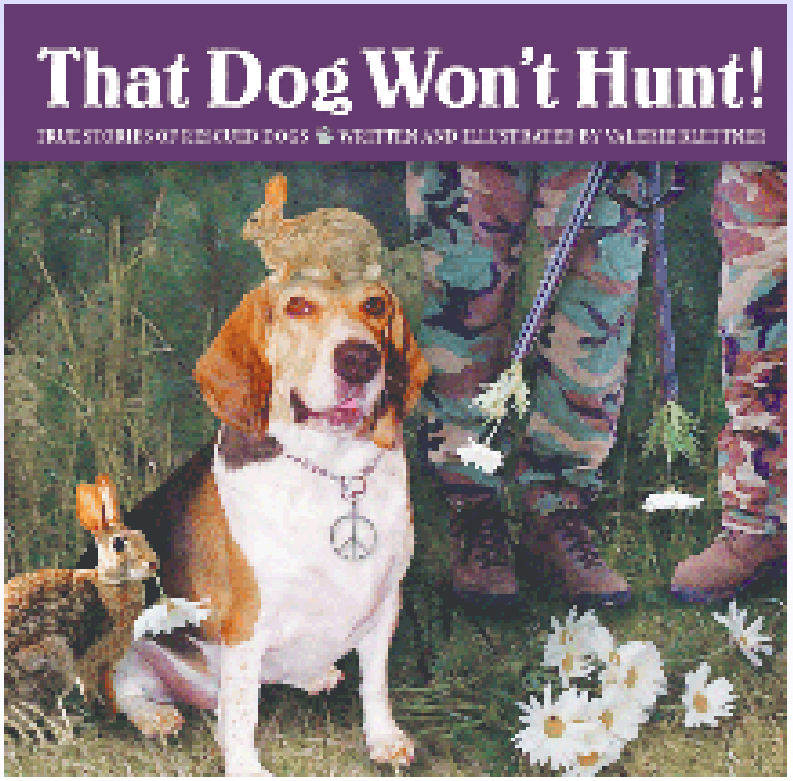
- **R6 involvement with no migration petitions**
  - **Petition review process has evolved since 1989**
  - **Learned which “knobs” are important**

Overview

- **R6 no migration petitions**
  - **Regulations are defined in 40 CFR Part 148**
  - **Operators must demonstrate restricted hazardous waste will remain within a defined injection zone for 10,000 years**
  - **To a reasonable degree of certainty standard - mandated by Congress**
  - **2+ years evaluation process**
  - **Standard *deterred* the disposal of restricted hazardous waste**

No Migration Standard

- **The no migration standard is not a practical approach for the geologic sequestration of CO_2!**
  - **Time consuming and costly process**
  - **Would discourage geologic sequestration**
  - **Recognize the differences**
    - **Some leakage may be acceptable - ensuring no negative impacts to human health and the environment**
    - **CO_2 is not RCRA hazardous**
    - **Shorter timeframe for containment**



Picture from Grinning Beagle Productions

No Migration Modeling

- **Simple numerical or analytical models are typically used for R6 no migration demonstrations**
- **Use a range of key variables to maximize the pressure buildup and plume movement – *bounding concept***
- **CO_2 modeling is *more complex***
  - Does the complexity have to be brought into the regulatory process?

No Migration Modeling

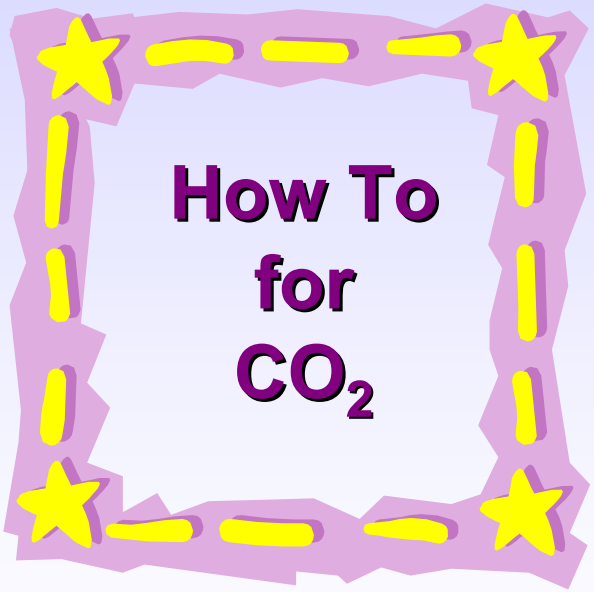
- **Bounding concept**
  - **Identified the big "knobs" or inputs**
    - **Transmissibility (kh/μ) for pressure buildup**
    - **Mobility (k/μ) for plume**
    - **Geologic features**
    - **Artificial penetrations**
  - **Model end ranges to maximize pressure buildup and define the largest plume area**
- **Not all geologic environments are conducive to injection activities**

Timeframes of Interest

- Active injection operation period
  - Pressure buildup in the reservoir
- Post operational period
  - Updip movement of buoyant plumes
  - Vertical containment of buoyant fluid
    - How much overlying strata is sufficient?
    - Can the plume enter the abandoned well?

Authorization Process

- **Define a general framework relying on a "bounding" concept for the geologic sequestration of CO_2**
  - ***Simplify the authorization process***
    - **Define the "knobs" or important modeling parameters**
    - **Set a reasonable timeframe for containment**
    - **Adopt a broader containment standard**
    - **Allow Director discretion to simplify or enhance requirements for a specific site**



Conclusion

- **No migration demonstration is not a practical approach for authorizing CO_2 geologic sequestration**
- **Differences necessitate an alternative approach**
- **Maintain a reasonable time, effort, and cost to the process – "bounding" approach**
- **Keep the "Big Picture" in mind**

Benefits of Sequestration

EPA Region 6
Dallas, TX