

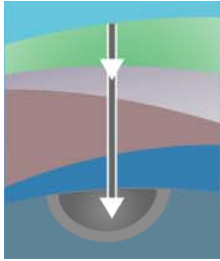


USEPA Vulnerability Evaluation Framework: What We've Learned and Moving Forward...

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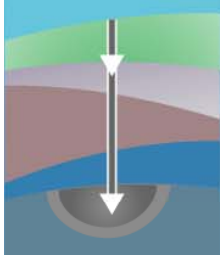




Outline

- Background
- VEF
- Lessons learned
- Moving forward





Background: Role of EPA

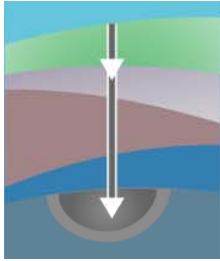
Audience

- Environmental regulators (State/local)
- Public

Risk/Vulnerability Assessment Goals

- Risk management
- Public confidence
- Improved understanding

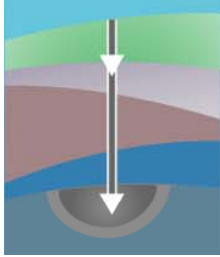




Key Questions

- Who is the audience?
 - Motivation: Legislature vs Regulator vs Public
- What is practical?
 - Help us better regulate CCS
 - Makes sense economically
- How do we prioritize?
 - Showstoppers
 - Near and long-term research goals

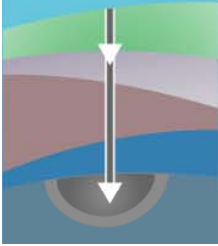




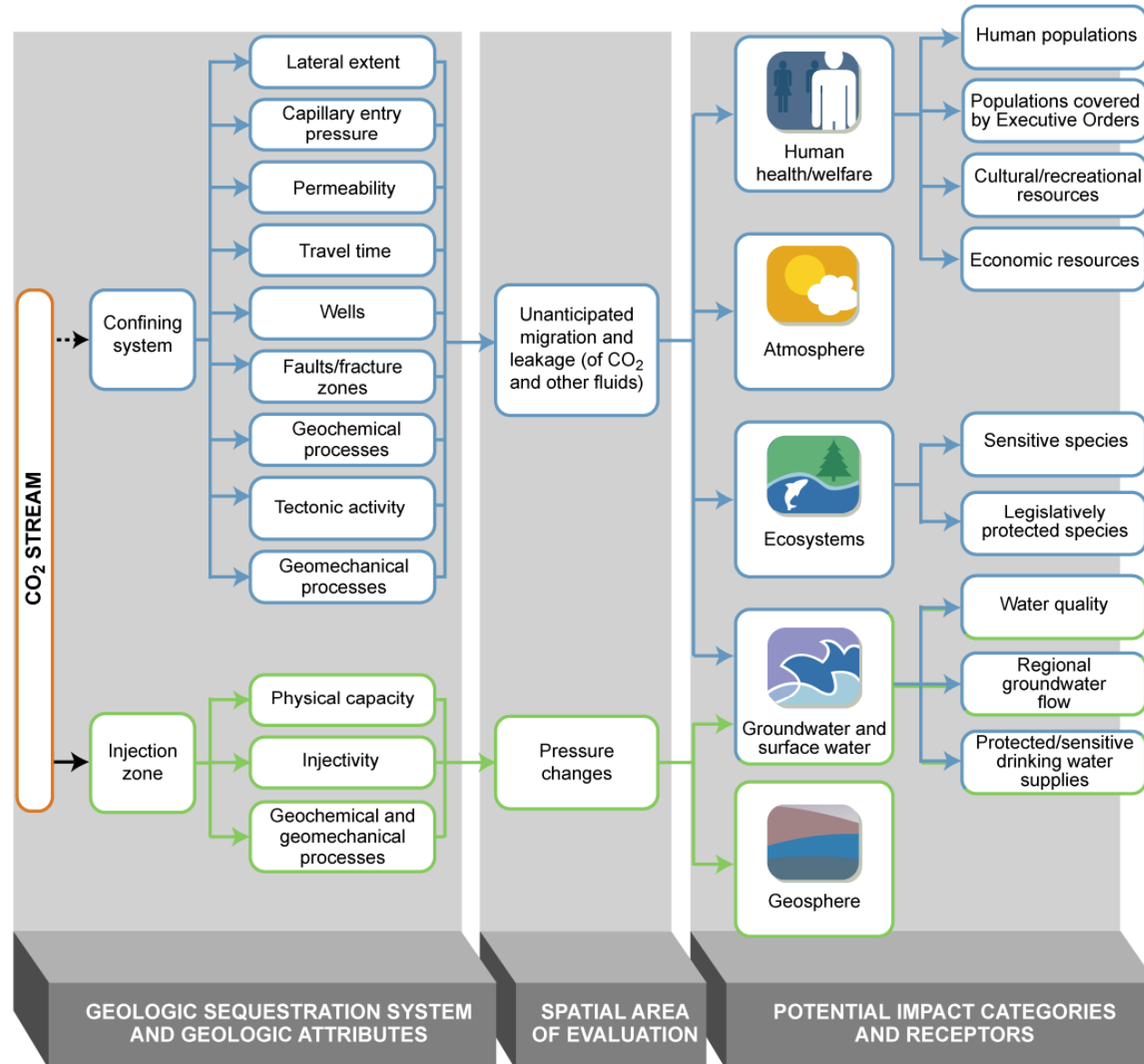
What is the VEF?

- Conceptual model was developed by EPA in 2006 based on technical expertise and existing literature
- Identifies key geologic attributes of GS systems (subsurface) that may lead to increased vulnerability to adverse impacts
- Suggests systematic approaches to evaluating attributes and impacts

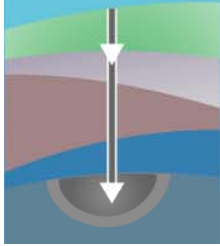




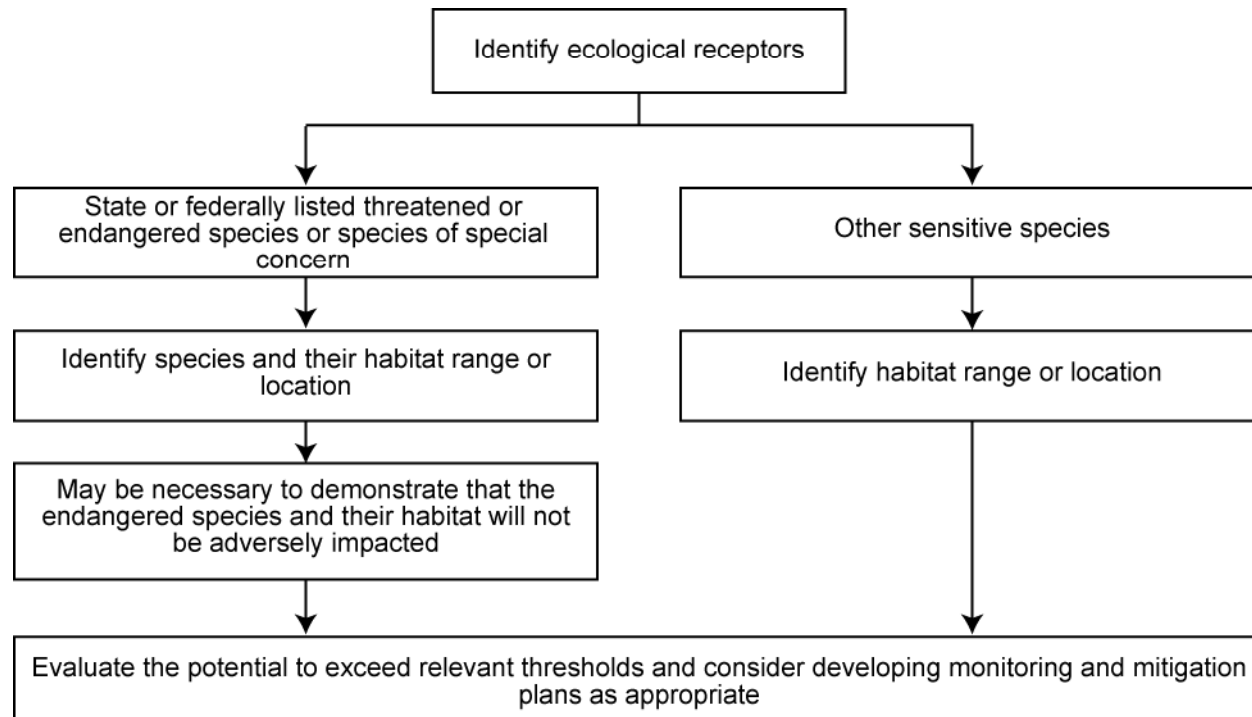
VEF Conceptual Model



Source: U.S. EPA. 2008. Vulnerability Evaluation Framework for Geologic Sequestration of Carbon Dioxide (EPA430-R-08-009)

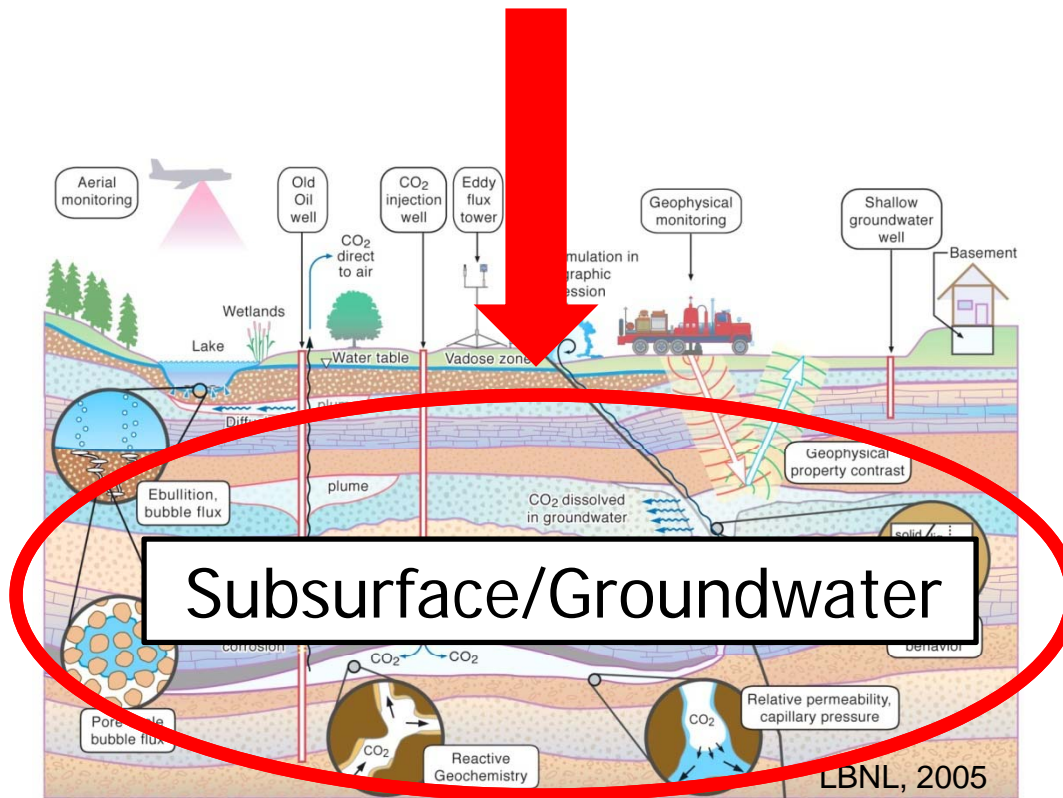


Ecosystems Impacts Flowchart



Lessons Learned

Key Research Focus



What?

- Potential for leakage
- Specific impact categories, e.g. groundwater/water use

Who?

- Department of Energy
- Academia
- EPA

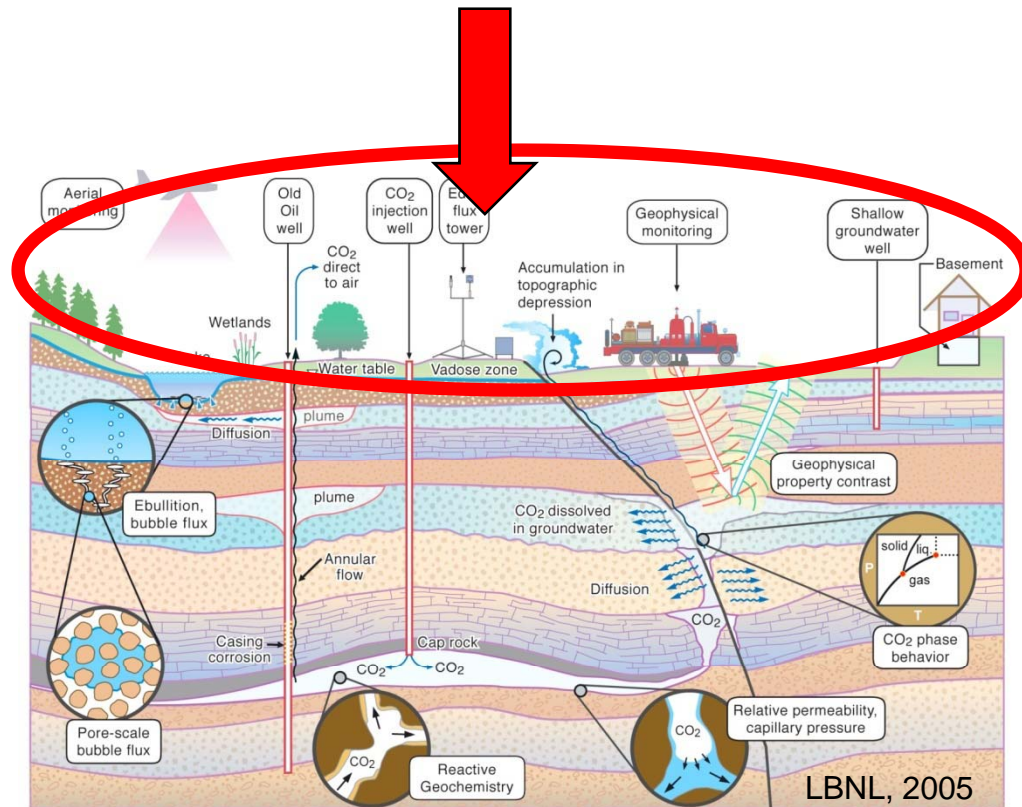
Why?

- Target for storage
- Groundwater impacts primary concern of stakeholders/public



Lessons Learned

Less Known About Other Impacts

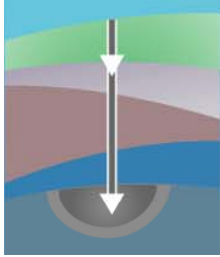


Based on:

- Case studies
- Dose-response studies

Our work on VEF highlighted areas for future work...

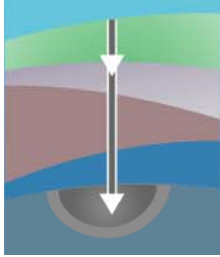




Lessons learned: Unresolved issues?

- What are the effects of CO₂ on individual receptors (e.g. soil microbes, sensitive populations, etc.)?
- What are the effects of CO₂ on representative ecosystems, including ecosystem processes and services?
- Can we identify indicator species?
- How do we account for multiple stressors on the potentially impacted environment?

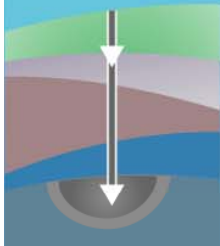




Lessons learned: Unresolved issues?

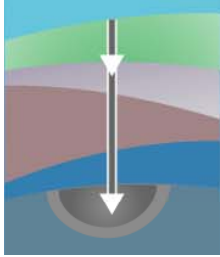
- What do we monitor for and for how long (e.g. changes in plant respiration, soil chemistry, biodiversity, etc)?
- Can we identify quantitative or qualitative thresholds for receptor impacts (e.g. changes in soil chemistry, biodiversity measures, etc.)?
- Should storage capacity estimates be constrained based on factors that could increase potential impacts (e.g. for economic modeling)?
- How do we communicate what we learn?





Public Confidence





Moving forward

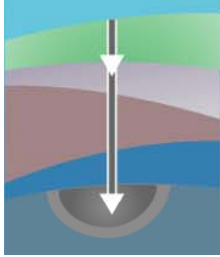
- Practical application of VEF
 - Case studies
 - Evaluate utility to permit writers and further develop as needed
- Address Key Questions...
- Thank you!





Background Slides





Proposed UIC GS Rulemaking

Public Hearings

- September 30, 2008: Chicago, IL at the EPA Region 5 Office
- October 2, 2008: Denver, CO at the Colorado Convention Center

To Comment

- www.regulations.gov
- Comments to Docket ID No. EPA-HQ-OW-2008-0390
- Public comment period ends November 24, 2008

