Lessons Learned: Major Demonstration/Integrated Projects

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Regional Carbon Management Applicant Education Workshop

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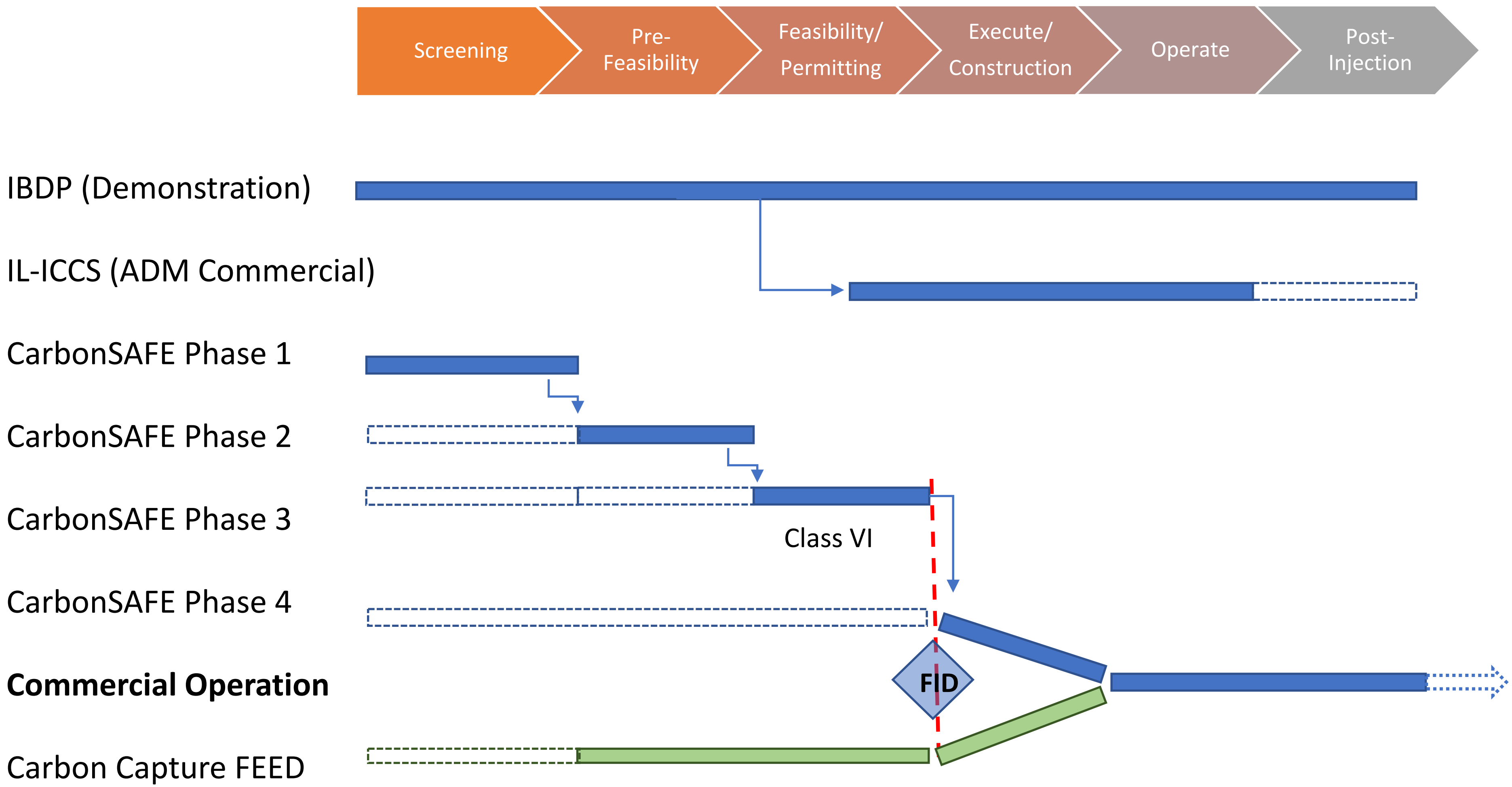
Illinois Projects and the CCUS Workflow



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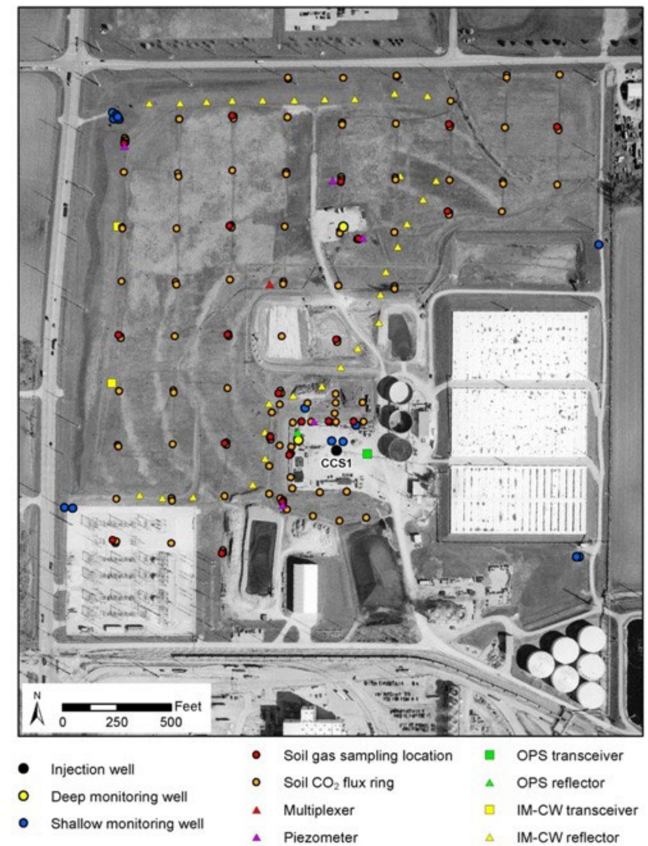
Illinois Basin – Decatur Project (2006-2021) Carbon Storage: Demonstrated Technology

- Captured, transported, stored, and monitored 1 million tonnes of CO_2 from biofuel production in an onshore Saline Reservoir
- First-of-a-kind monitoring, verification, and accounting program
- Met and exceeded all technical and non-technical challenges
- Successful Class VI permitting
- Conducted microseismic monitoring and interpretation
- Developed International collaborations
- Laid foundations for multiple projects
- Build international, national, and regional capacity
- Stakeholder engagement strategy built trusted relationships
- Created comprehensive data set



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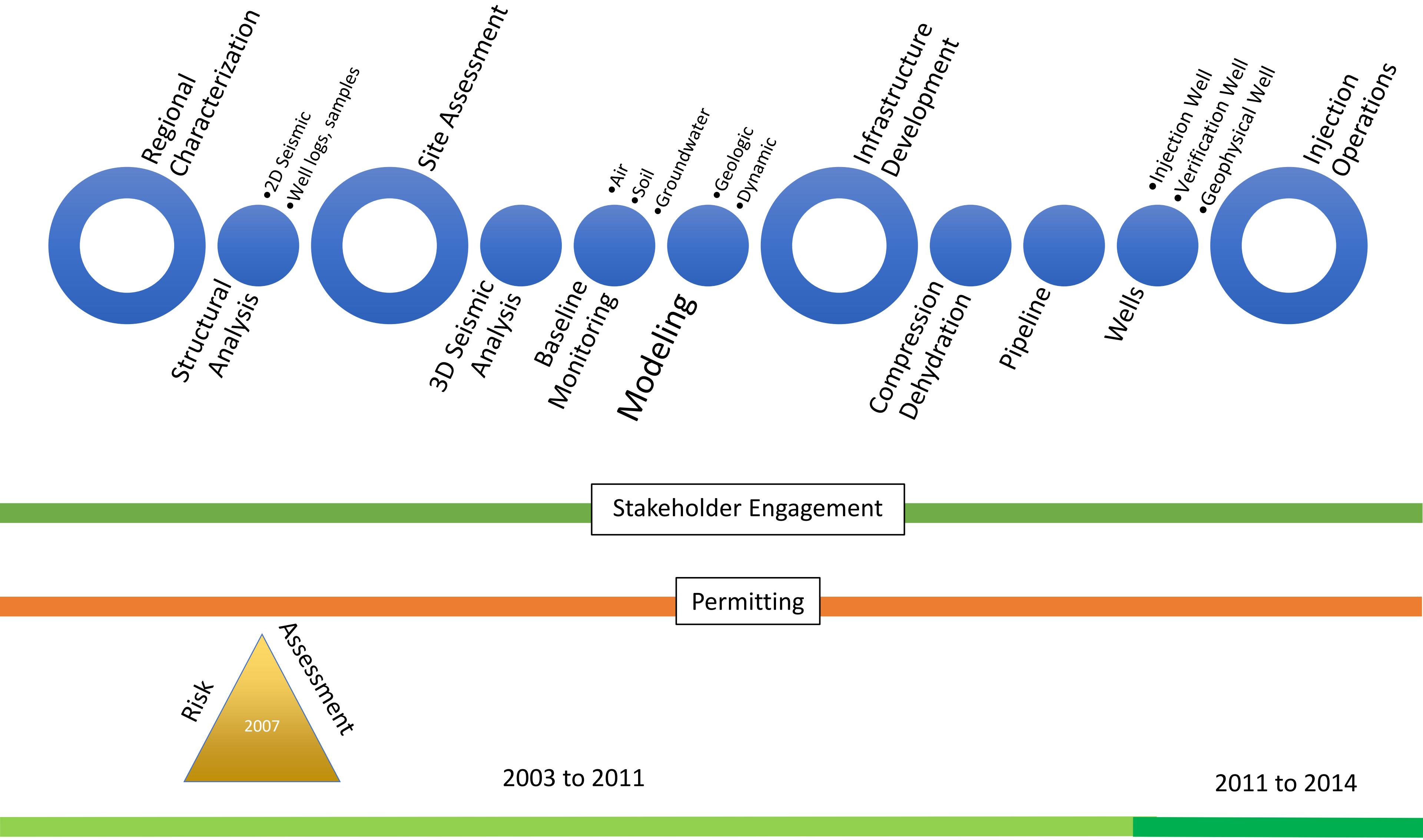
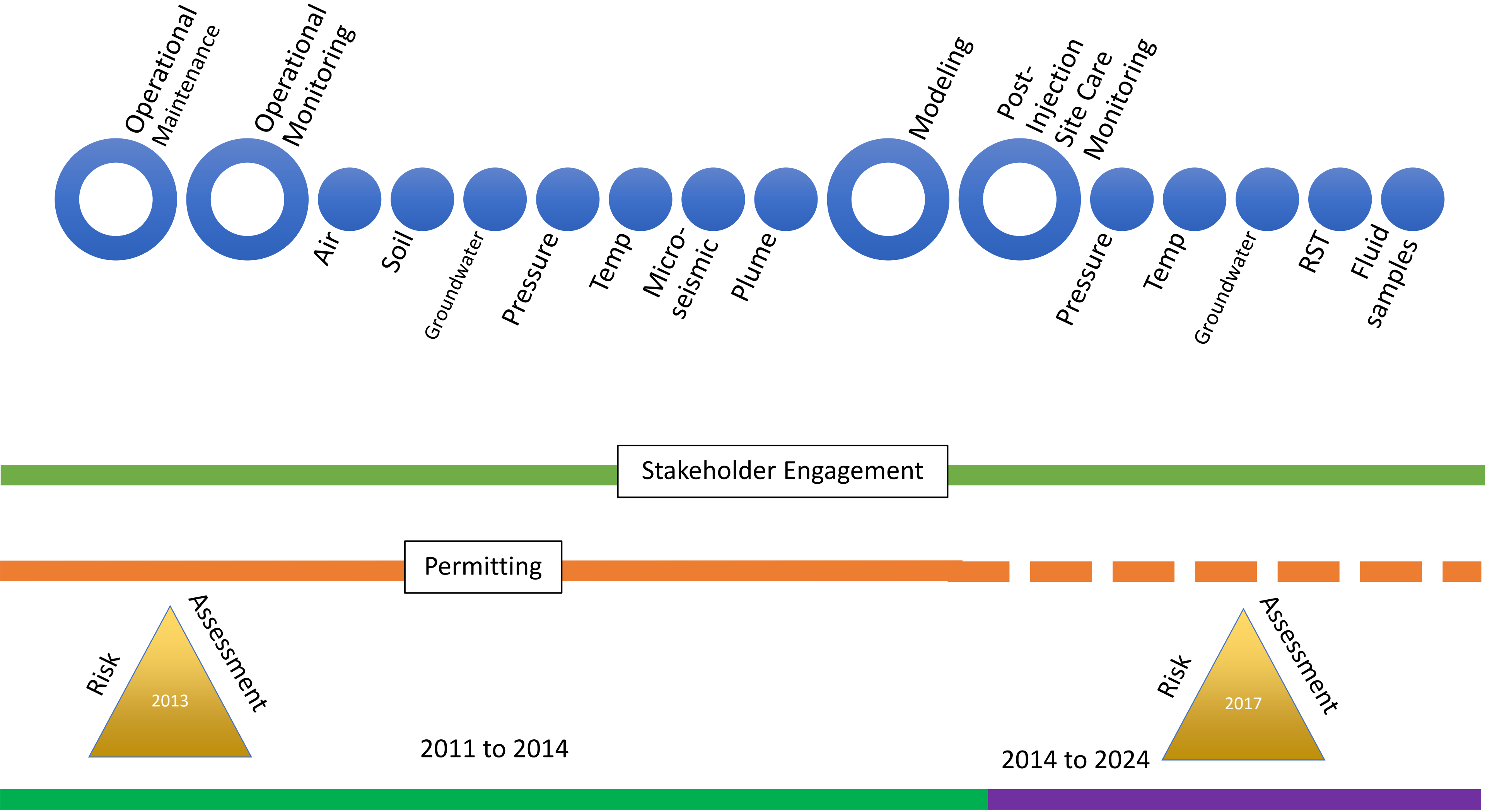
VW2
GM2
Class VI permit issued Dec 2014
Class VI injection started Apr 2017
CCS2
NSEC
Richland Community College
VW1
GM1
Class VI permit issued Feb 2015
Class VI PISC started Feb 2015
CCS1
ADM Facility
North
~800 meters

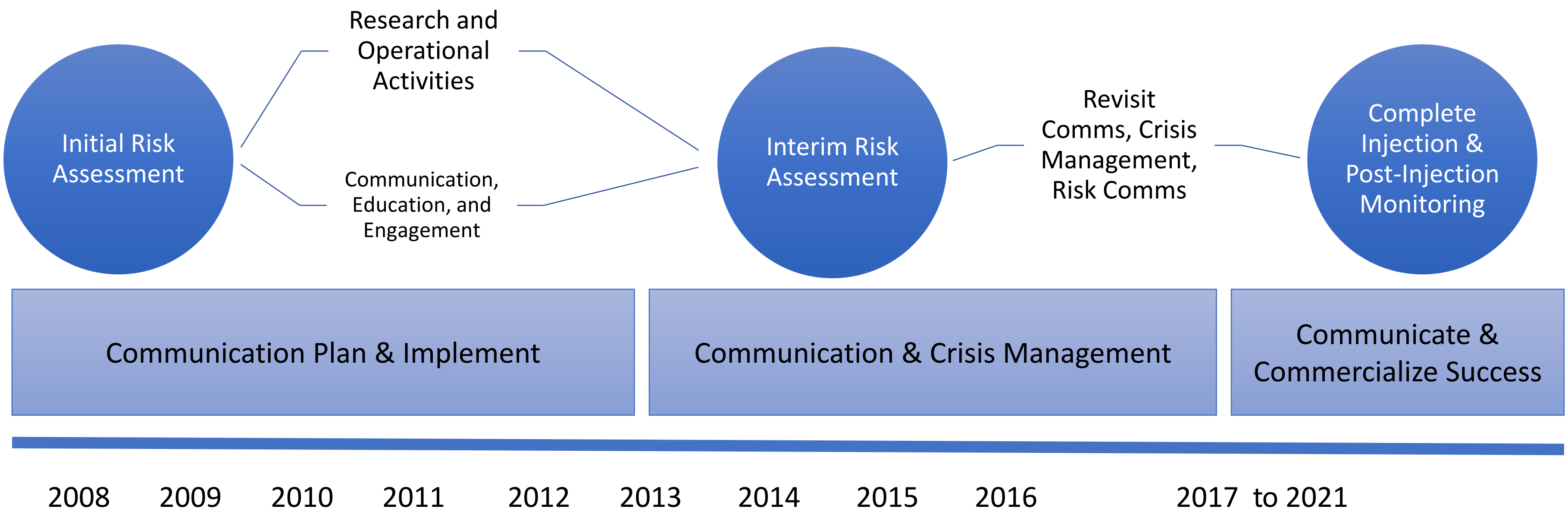
Development of a CCS Project



Development of a CCS Project



IBDP Risk Assessment and Project Uncertainties



Geologic Uncertainty
Operational Uncertainty
Regulatory Uncertainty
Social Uncertainty

Regulatory Uncertainty

Change in Scope
Long-term Funding
Challenges in Knowledge Sharing
Complacency Potential
Institutional Memory Loss

Regulatory Uncertainty

Funding Uncertainty
Transferring Knowledge
Sharing Data
Maintaining Capacity
Finishing Strong

Lessons Learned from IBDP

- Geology is critical and will always remain key factor
- Iterative scientific investigation allows for advancement and economy of scale
- Unanticipated results provide insights into improvements that benefit all projects
- Incorporate technology changes into life cycle of project
- Risk-based approach frames safety, mitigation, and planning
- Occom’s Razor applies to CCUS
- Scientific and engineering timeframe not aligned with policy
- Pilot and demonstration projects provide critical insights
- Policy drivers are necessary to facilitate commercialization
- Regulatory, legal, and social factors require significant time investment

Regulatory Lessons

- Start early – but know when the clock actually starts
- Familiarize yourself with regulatory time clock
- Proactively engage regulators
- Seek out examples (publicly available)
- Public engagement guidelines should be exceeded
  - Proactive approach increases transparency
  - Move beyond formal engagement requirements
- Environmental baseline essential regardless of regulatory requirements
  - Risk mitigation
  - Support CCS primary deployment goals
- Provide balance of information – detail important, but can distract
- Modeling
  - Simple
  - Open source or accessible software

Suggestions for Working with U.S. DOE

- Plan for long-term operations
- Have robust accounting and compliance in place
- Prepare in advance for audits
- Understand cooperative agreements, flow down provisions, cost-share expectations and rules
- Plan for scope creep, unexpected requests
- Provide detail updates and successes
- Plan for changes in PI or key personnel
- Consider foreign national approval implications