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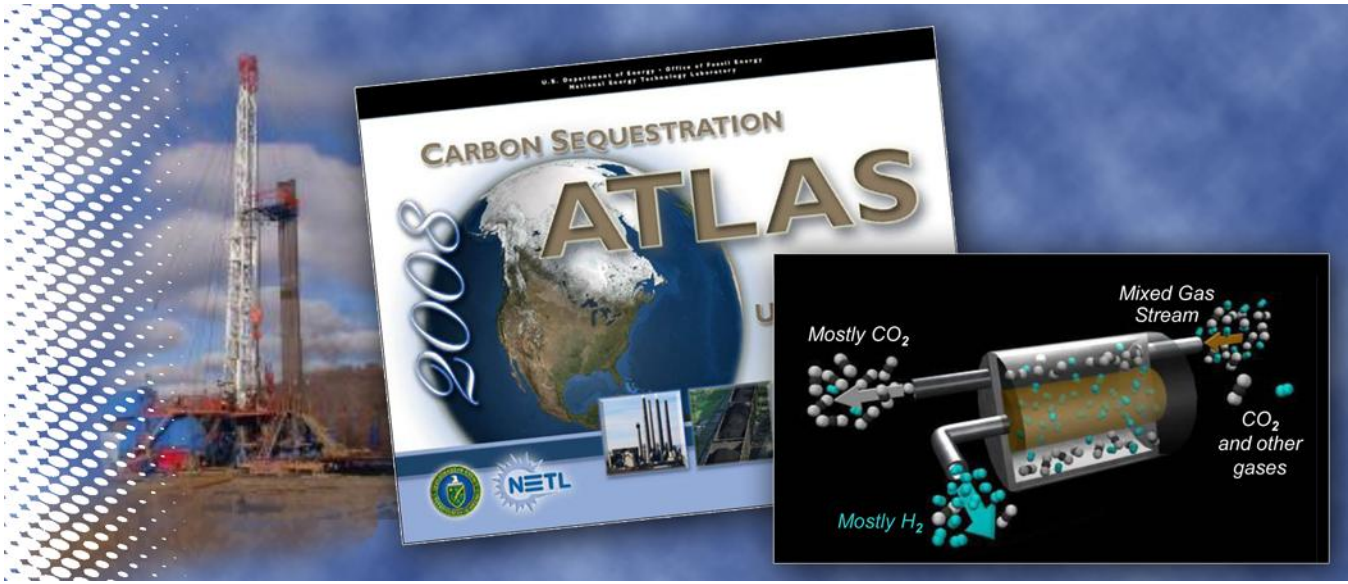

Site Screening, Selection and Characterization of CO_2 Stored in Deep Geologic Formations

ARRA Site Characterization Projects Kick-Off Meeting

February 2010

Site Screening, Selection and Characterization of CO_2 Stored in Deep Geologic Formations

- **Provide stakeholders and greater sequestration community a compilation of best practices on site screening, selection and characterization**
- **Develop a consistent (industry standard) framework, terminology and guidelines for communicating "project" related storage/capacity estimates and risk associated with project development**
- **Communicate experience gained and processes developed through DOE Regional Partnerships Program (Characterization through Validation Phases)**

Geologic Storage Framework

One Consistent and Proven Framework

- **Create Framework –** to categorize storage assessments from Prospective Storage through "project development" to Storage Capacity
- **Build on the current DOE Storage Classification** methodologies as defined by the DOE Atlas 2008/CSLF efforts
- **Adapt SPE/WPC/AAPG/SPEE Resource Classification System** (Petroleum Management System – PRMS)
- **Integrate knowledge from SPE/WPC/AAPG/SPEE, CO2CRC, Frailey, S.M. and Finley, R.J., and EERC**

Why Department of Energy?

Sequestration Program through the Regional Partnerships is currently developing the *Infrastructure* necessary for wide scale commercial deployment of CCS

and

Recently awarded Site Characterization Projects funded through American Recovery and Reinvestment Act of 2009 support the Sequestration Program Core Mission

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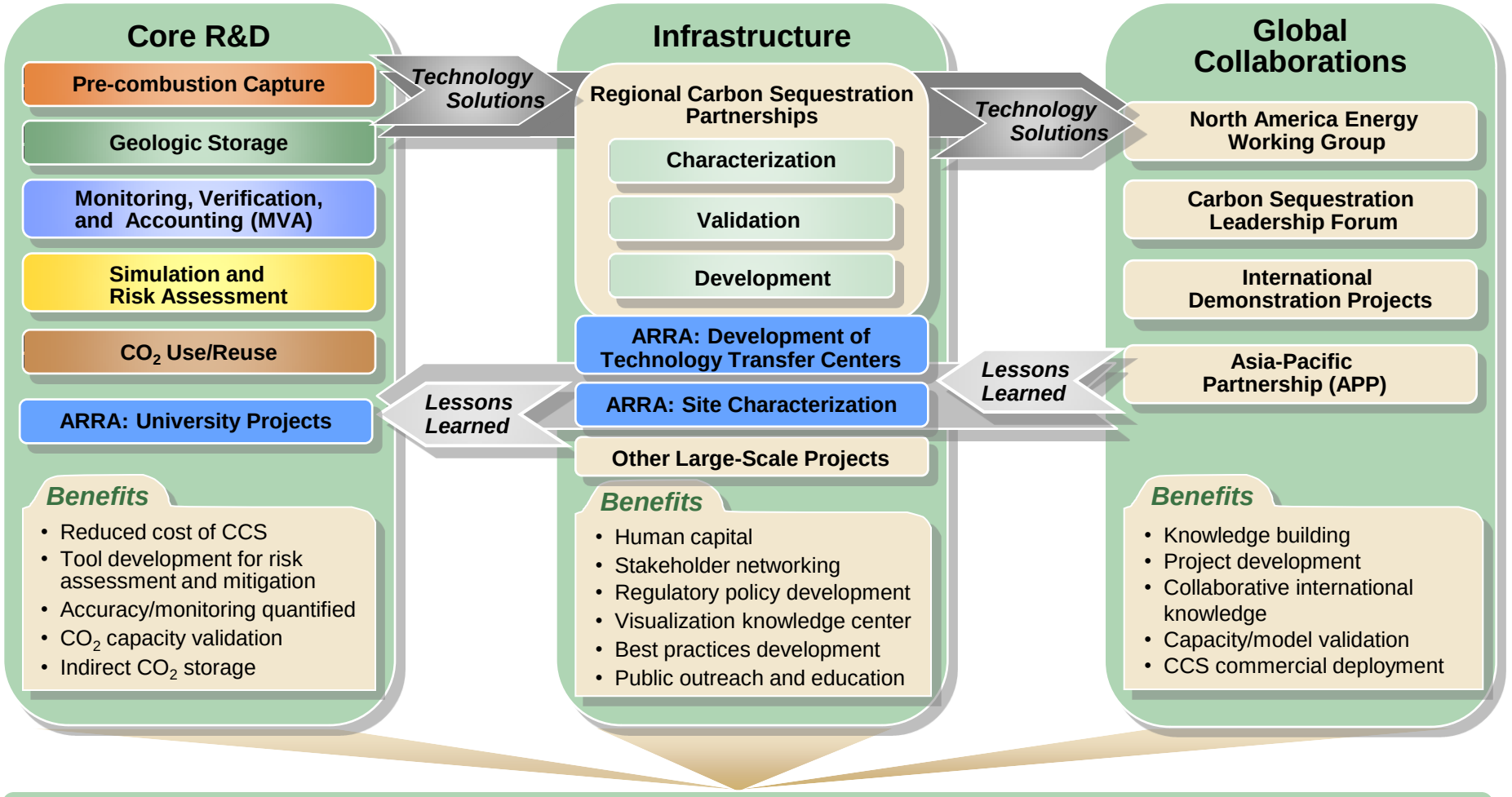
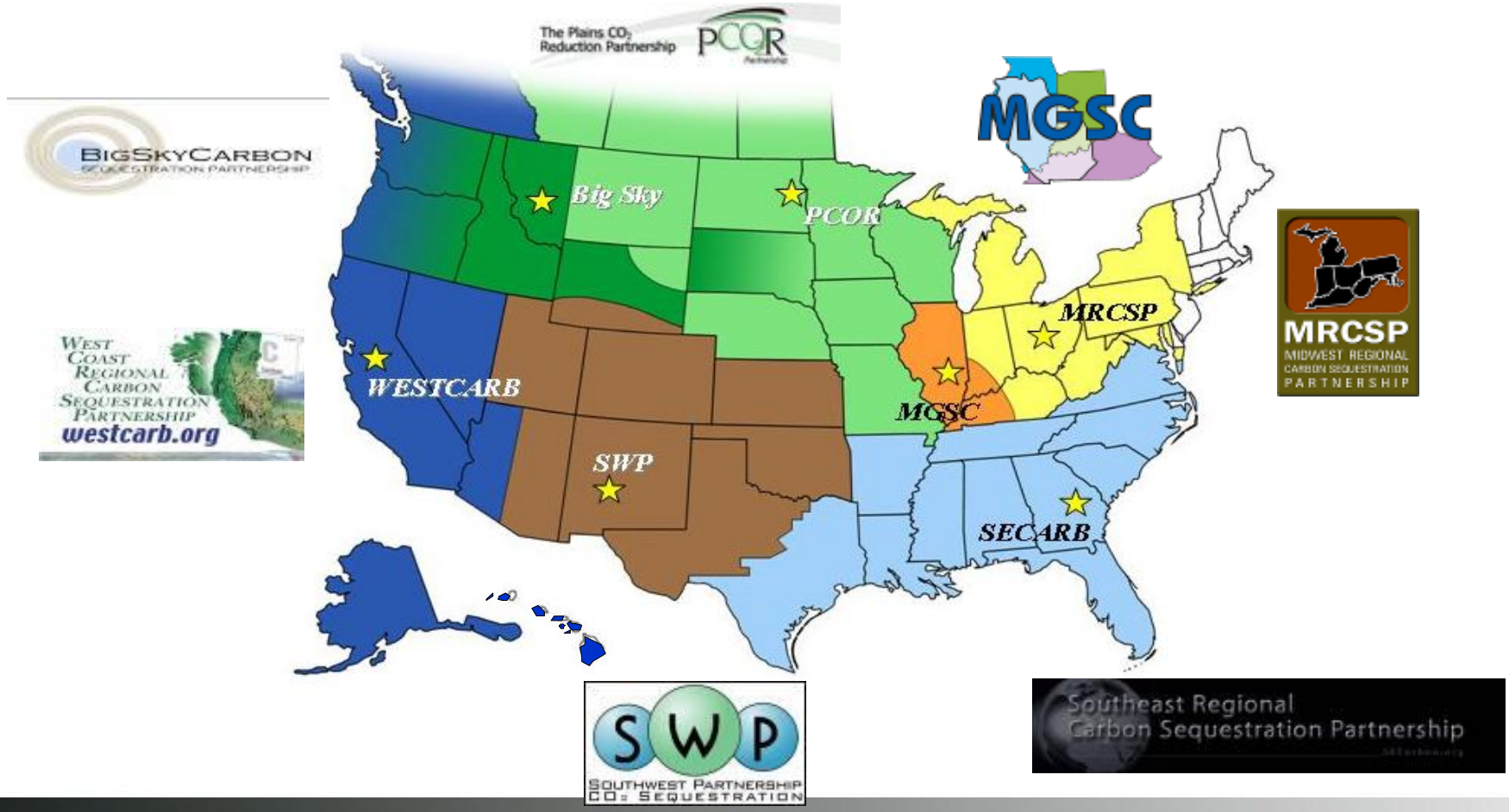
CARBON SEQUESTRATION PROGRAM with ARRA Projects



Demonstration and Commercialization Carbon Capture and Storage (CCS)

Regional Carbon Sequestration Partnerships

"Developing the Infrastructure for Wide Scale Deployment"



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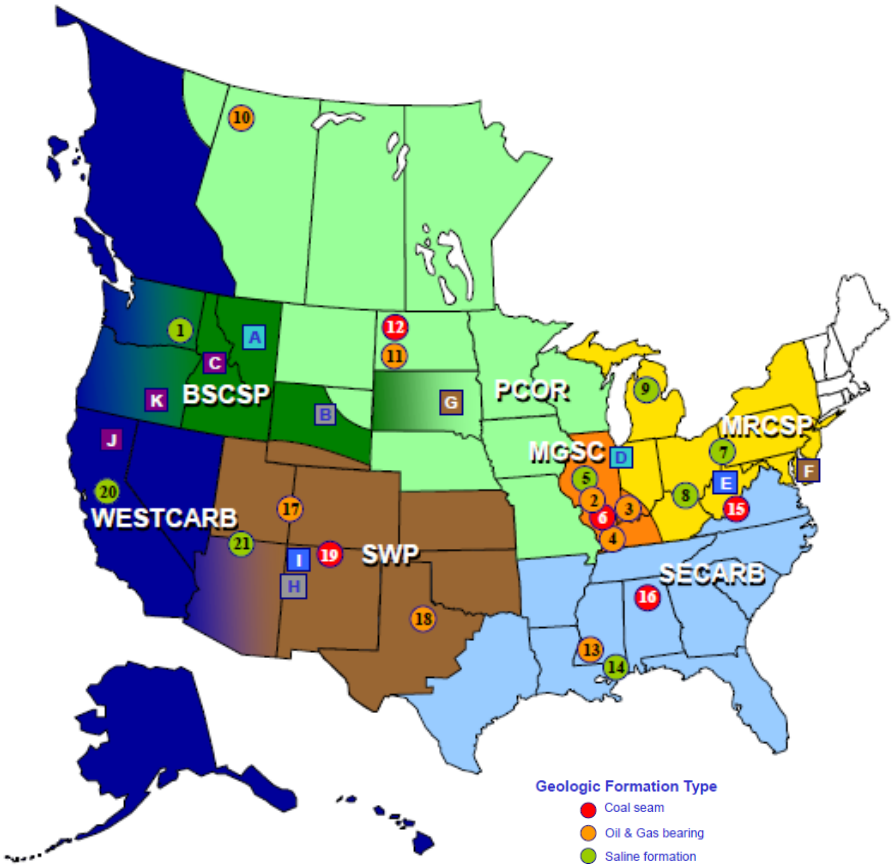
RCSP Phase II: Validation Phase

Small-Scale Geologic and Terrestrial Tests

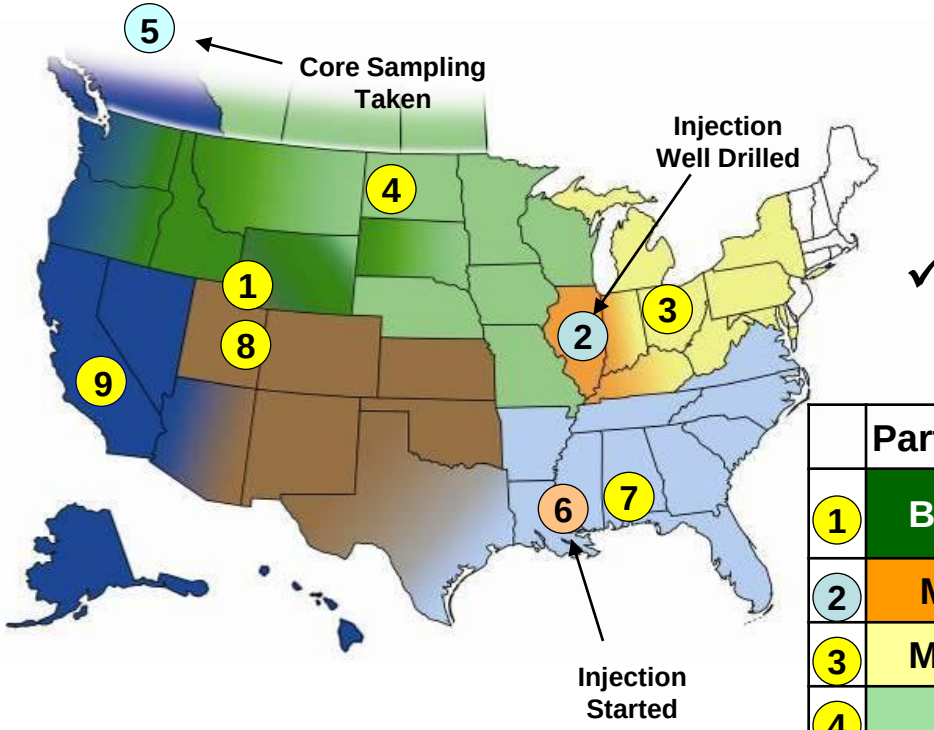


	Partnership	Geologic Province/ Location	Geologic: Total CO_2 Injection (tons CO_2)	Geologic: Approximate Depth (feet)	Terrestrial: Estimated CO_2 Capacity
1		Columbia Basin	0*	2,500 – 4,000	
A	Big Sky Carbon Sequestration Partnership	North Central MT			60 Mt over 20 years
B		Eastern WY			30 Mt over 10 years
C		Region-wide			640 – 1,040 Mt over 80 years
2	MGSC	Loudon Oil Field	< 50	1,550	
3		Mumford Hills Oil Field	2,700*	1,551	
4		Sugar Creek Oil Field	4,600*	1,548	
5		Illinois Basin	0*	6,650 – 7,050	
6		Illinois Basin	100	1,000	
7	MRCSP Midwest Regional Carbon Sequestration Partnership	Appalachian Basin	< 100	5,900 – 8,300	
8		Cincinnati Arch	1,000	3,200 – 3,500	
9		Michigan Basin	60,000	3,200 – 3,500	
D		Region-wide			25 Mt over 20 years
E		Region-wide			100 Mt over 20 years
F		Cambridge, MD			TBD
10	The Plains CO_2 Reduction Partnership PCOR Partnership	Keg River Formation	30, 000	5,000	
11		Duperow Formation	440	10,000 – 10,500	
12		Williston Basin	90	1,600 – 1,800	
G		Great Plains wetlands complex (PPR)			14.4 Mt
13	SECARB Southeast Regional Carbon Sequestration Partnership	Gulf Coast } stacked	500,000	10,304	
		Gulf Coast } stacked		10,400	
14		Mississippi Coastal Plain	3,082	8,600	
15		Central Appalachian	1,000	1,600 – 2,300	
16		Black Warrior Basin	0*	1,500 – 2,500	
17	SWP Southwest Partnership CO_2 Sequestration	Paradox Basin–Aneth Field	250,000	5,600 – 5,800	
18		Permian Basin	475,000	5,800	
19		San Juan Basin	18,430	3,000	
H		Region-wide			TBD
I		San Juan Basin Coal Fairway (Navajo City, NM)			TBD
20	West Coast Regional Carbon Sequestration Partnership westcarb.org	Sacramento Basin*	0*	8,000	
21		Colorado Plateau	0	4,000	
J		Shasta County, CA			4,600 Mt over 80 years (CA)
K		Lake County, OR			900 Mt over 80 years (OR)

* Currently injecting or will begin injecting in 2010

RCSP Phase III: Development Phase

Large-Scale Geologic Tests



2010/2011 Injection Scheduled

2011/2012 Injection Scheduled

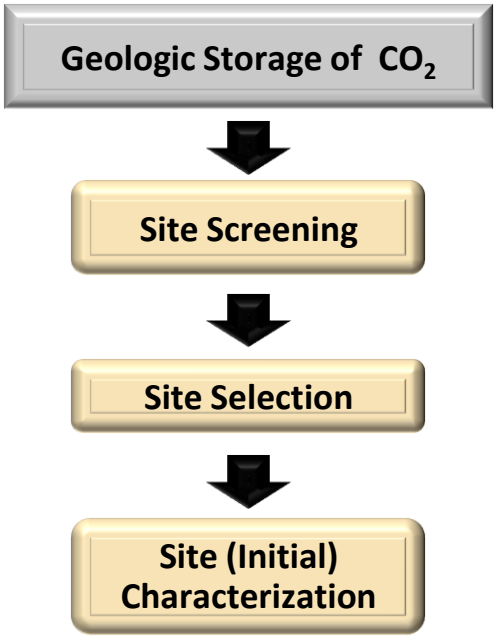
- ✓ *Nine large-volume tests*
- ✓ *Injections initiated 2009 – 2011*

	Partnership	Geologic Province	Type
1	Big Sky	Triassic Nugget Sandstone / Moxa Arch	Saline
2	MGSC	Deep Mt. Simon Sandstone	Saline
3	MRCSP	Shallow Mt. Simon Sandstone	Saline
4	PCOR	Williston Basin Carbonates	Oil Bearing
5		Devonian Age Carbonate Rock	Saline
6	SECARB	Lower Tuscaloosa Formation Massive Sand Unit	Saline
7			
8	SWP	Regional Jurassic & Older Formations	Saline
9	WESTCARB	Central Valley	Saline

Site Screening, Selection and Characterization

Integration into Classification Framework

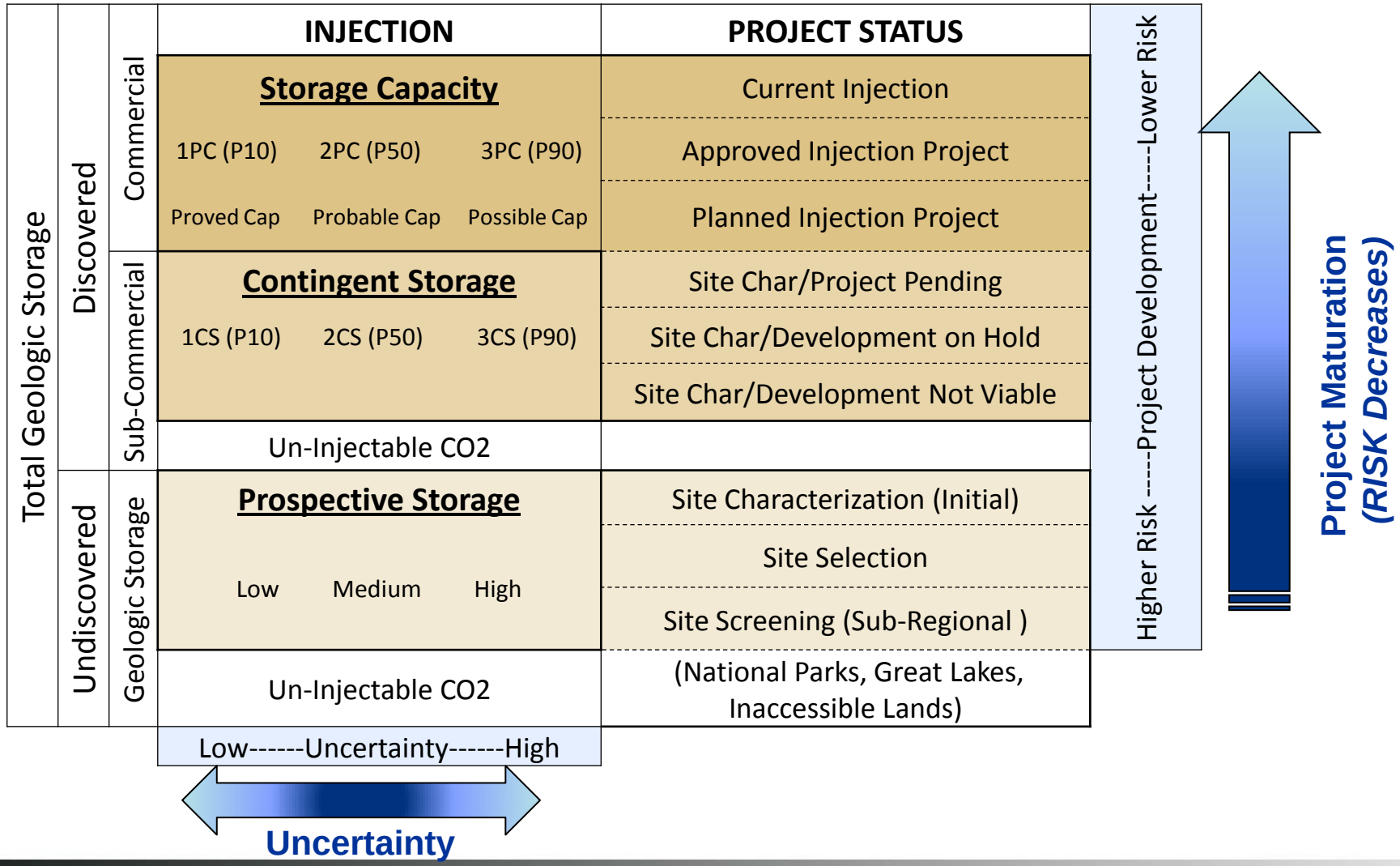
Integrate the developed processes and best practices from field projects into the Classification Framework; provide guidelines for data and analyses



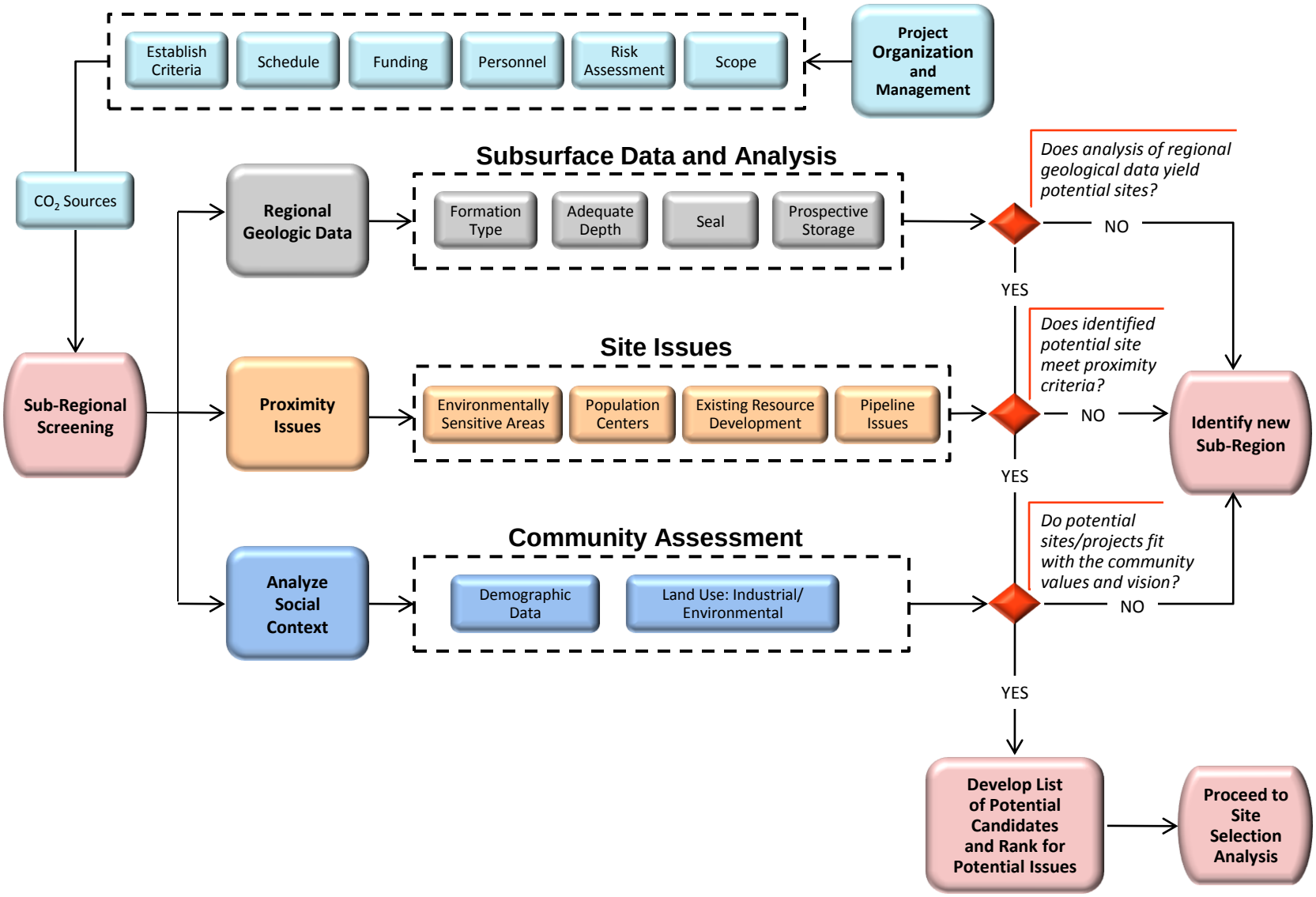
Progression through each level of "Project Site Maturation" increases significantly in time and funding

Geologic Storage Framework

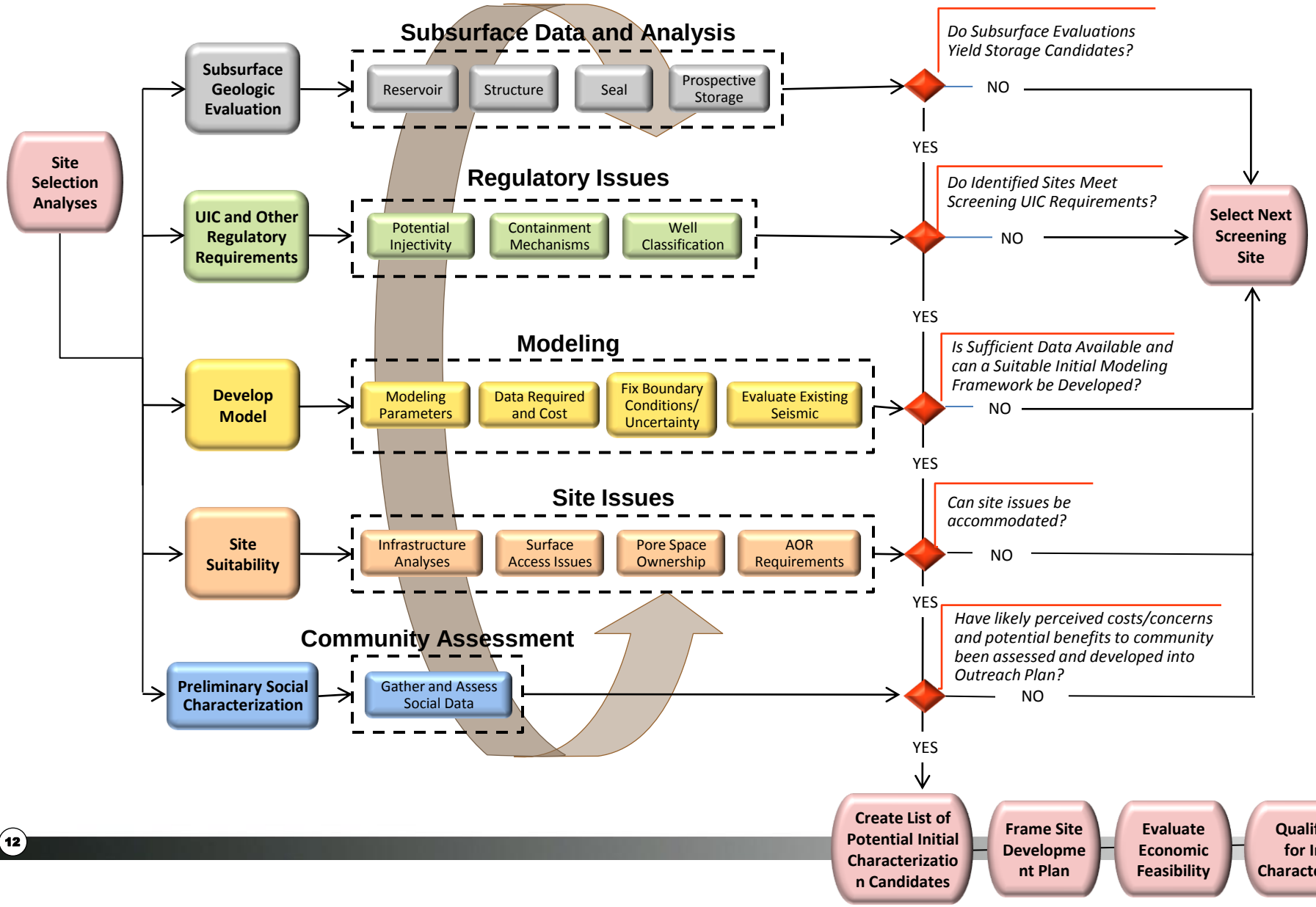
Adapted from SPE_WPC_AAPG_SPEE



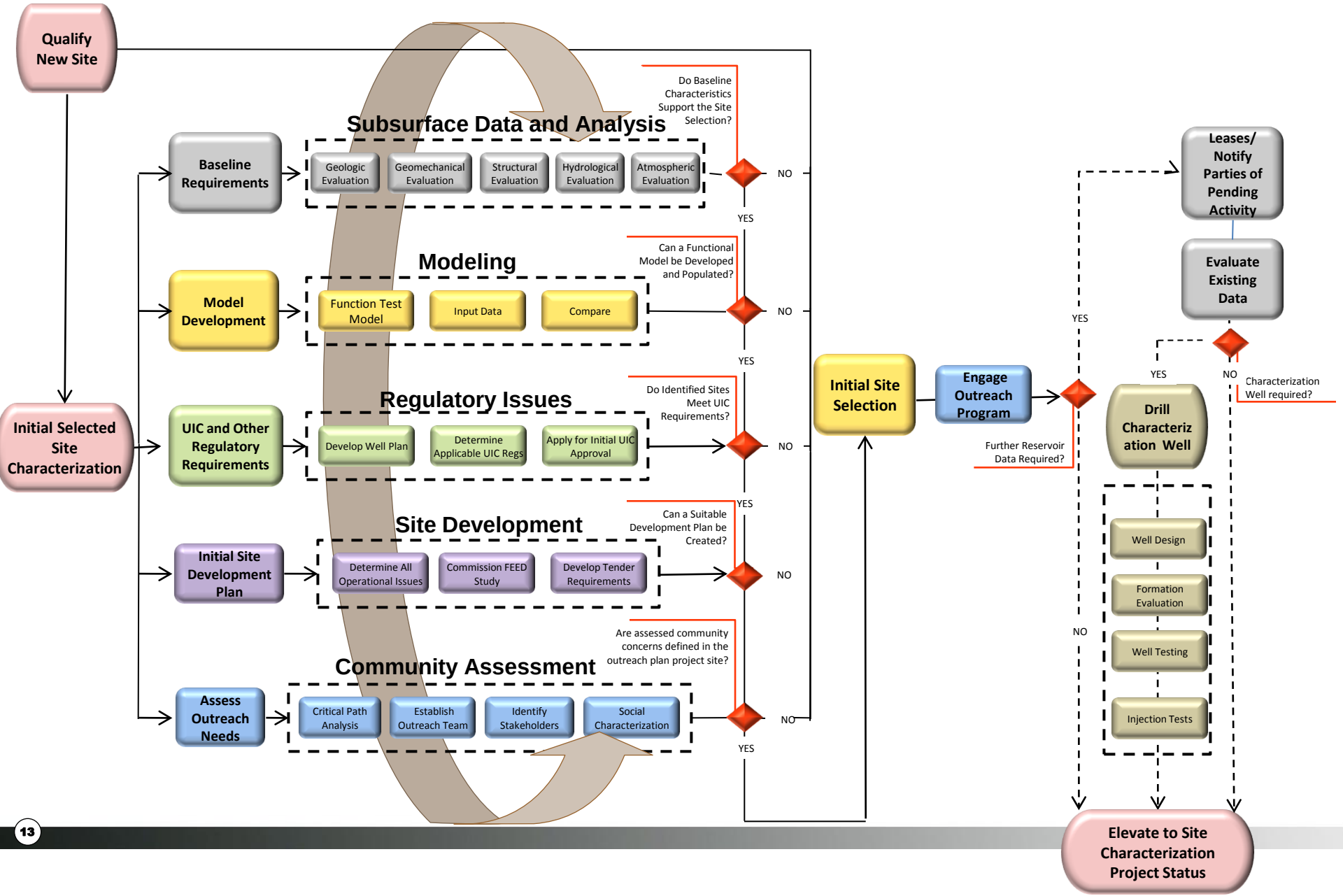
Site Screening Process Diagram



Site Selection Process Diagram

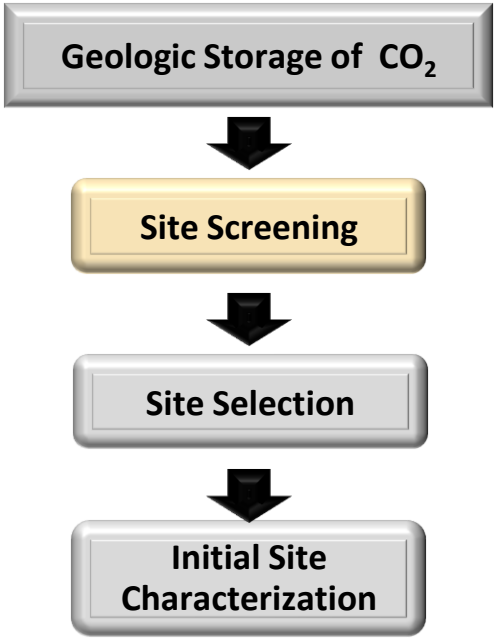


Site (Initial) Characterization Process Diagram



Site Screening, Selection and Characterization

Regional Geologic Evaluation of the Reservoir



Identification of potential sites in sub-region

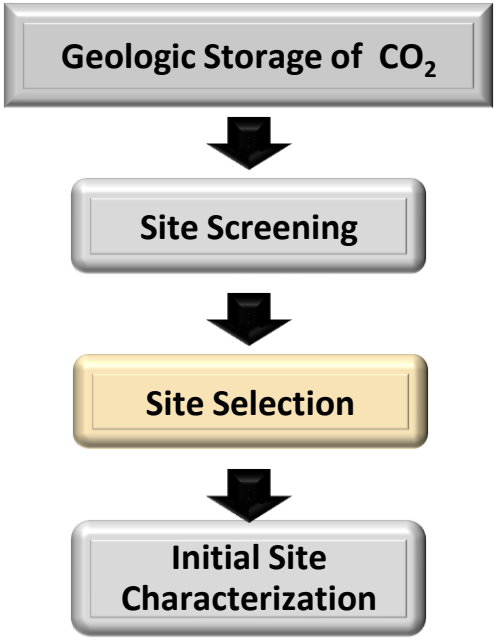
Utilize existing regional data in sources (such as NATCARB, Geological Surveys, and Regional Partnership databases) to identify regional potential:

- Identify potential storage/formations/wells
- Adequate depth
- Storage/source proximity
- Regional sealing mechanisms
- Initial regional storage potential

Does analysis of regional geological data yield potential sites?

Site Screening, Selection and Characterization

Subsurface Geologic Evaluation of the Reservoir



Site Selection Analyses

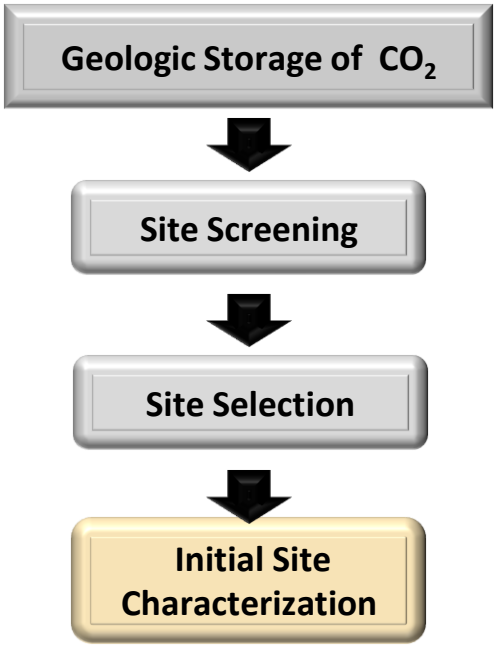
Begin initial reservoir evaluation at each site selected:

- Develop Type Log of Regional Stratigraphy
- Create maps of Reservoir Tops/Bases/Isopachs
- Develop initial well log correlations/cross-sections
- Evaluate and integrate analogous well data (perm, porosity, core, etc)

Does initial reservoir evaluation yield sufficient potential for further evaluation of sites?

Site Screening, Selection and Characterization

Baselines Characteristics—Geologic Eval-Reservoir



Perform Initial Site Characterization

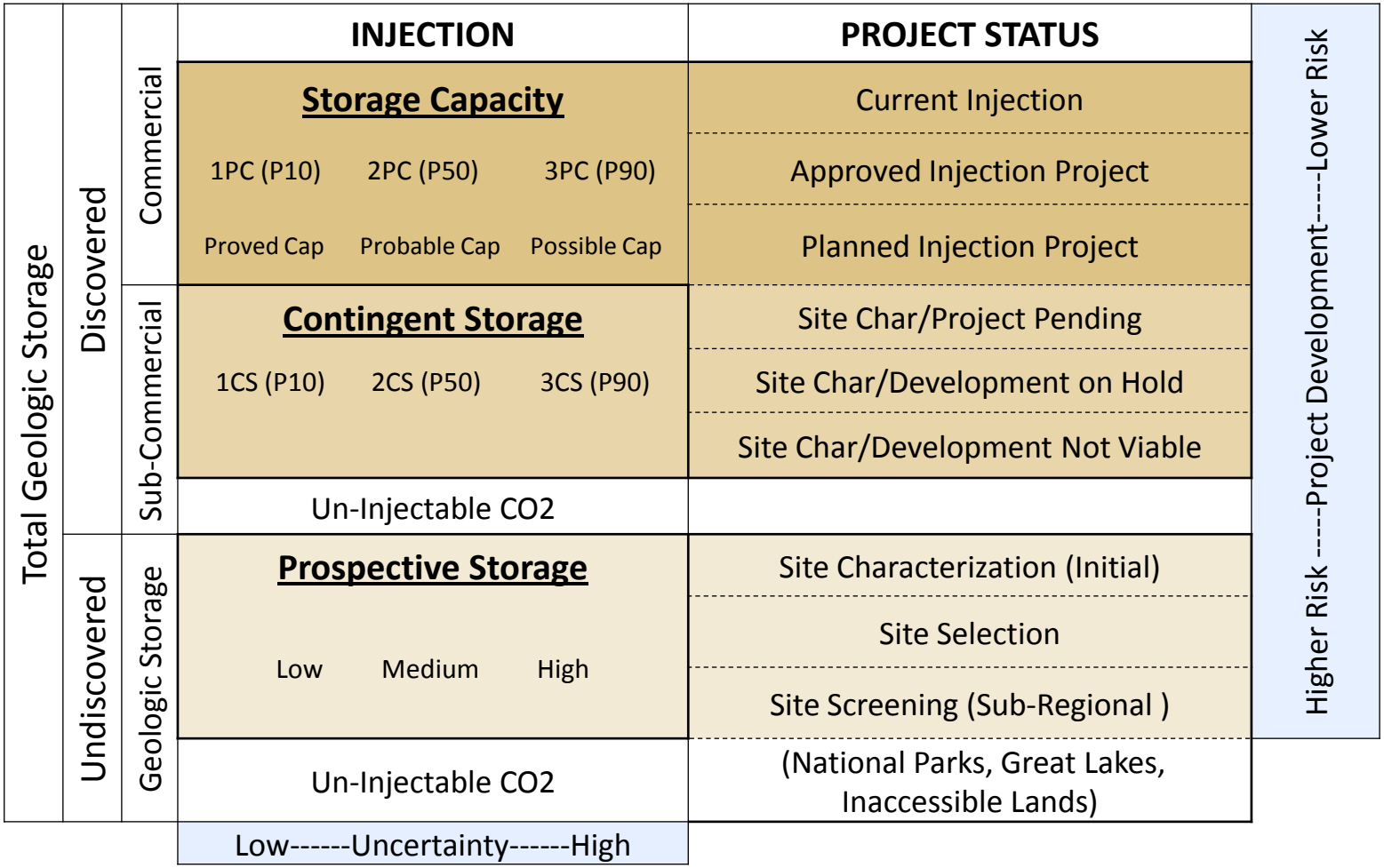
Begin in depth geologic characterization of reservoir:

- Type Log of stratigraphy for site area
- Detailed correlation of reservoir architecture and sequence stratigraphy in the area
- Develop appropriate models— (depositional/ facies/digenesis)
- Assess porosity permeability and develop maps
- Advanced analysis in well logs, advanced logs/tests in existing wells, cores
- Potentially Seismic data
- Integrate all data into ***Initial Stratigraphic Model***

Does extensive geologic evaluation on the reservoir support the Baseline Characteristics Site Characterization?

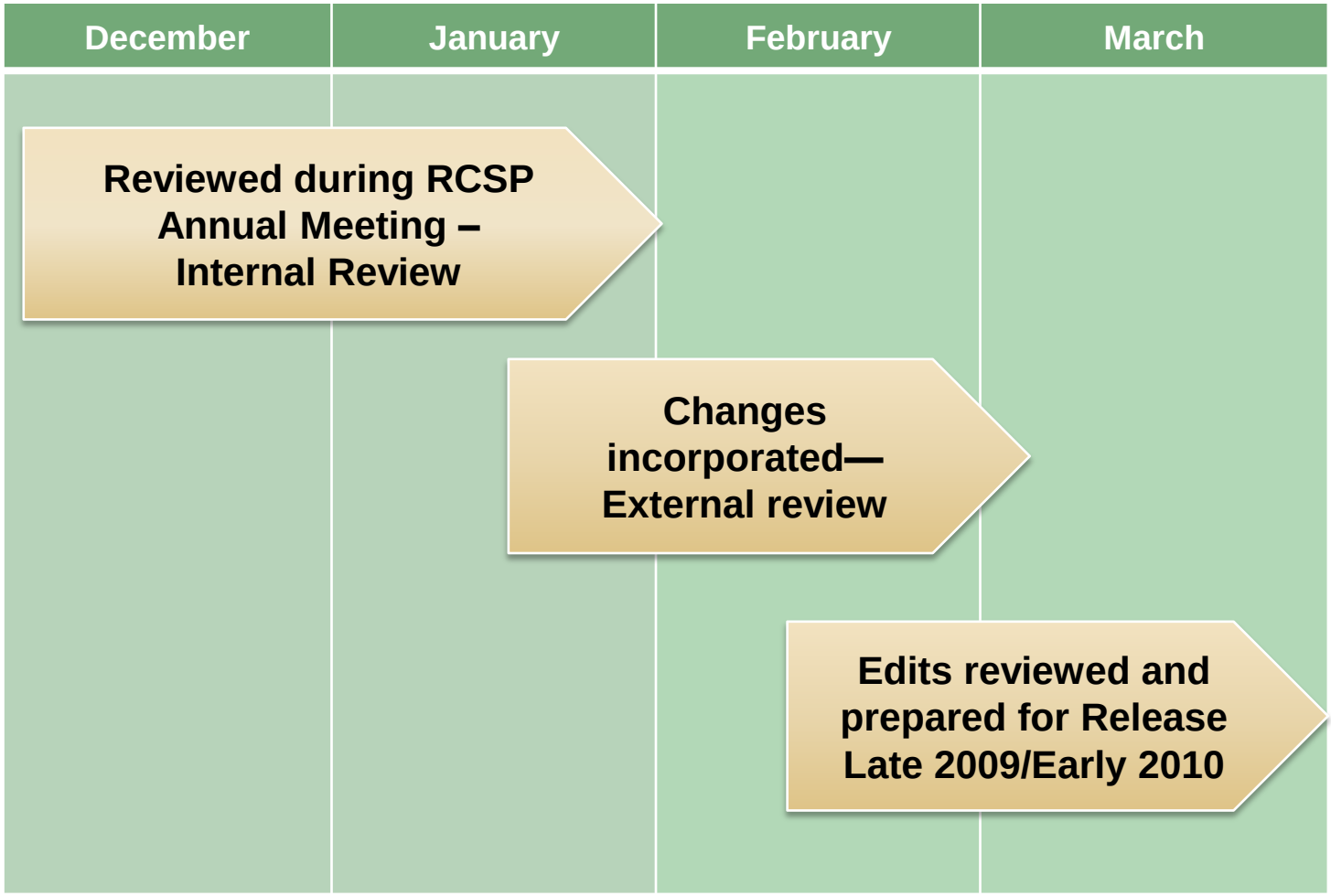
Geologic Storage Framework

Adapted from SPE_WPC_AAPG_SPEE



Next Steps

Site Screening, Selection and Characterization



CCS Best Practice Manuals

Critical Requirement For Significant Wide Scale Deployment -Capturing Lessons Learned

Best Practices Manual	Version 1 (Phase II)	Version 2 (Phase III)	Final Guidelines (Post Injection)
Monitoring, Verification and Accounting	2009	2017	2020
Site Characterization	2010	2016	2020
Simulation and Risk Assessment	2010	2017	2020
Well Construction/Operations/Closure	2010	2017	2020
Regulatory Compliance	2010	2016	2020
Public Outreach and Education	2009	2016	2020
Terrestrial	2010	**2016 – Post MVA Phase III**	

Questions?