NRAP: Tools for Geologic Carbon Storage Risk Assessment

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NRAP
National Risk Assessment Partnership

NATIONAL ENERGY TECHNOLOGY LABORATORY

BERKELEY LAB

Los Alamos NATIONAL LABORATORY EST.1943

Pacific Northwest NATIONAL LABORATORY

U.S. Geologic Storage Capacity

Estimates of CO_2 Stationary Source Emissions and Estimates of CO_2 Storage Resources for Geologic Storage Sites

RCSP or Geographic Region	CO_2 Stationary Sources		CO_2 Storage Resource Estimates (billion metric tons of CO_2)								
			Saline Formations			Oil and Gas Reservoirs			Unmineable Coal Areas		
	CO_2 Emissions (million metric tons per year)	Number of Sources	Low	Med***	High	Low	Med***	High	Low	Med***	High
BSCSP	115	301	211	805	2,152	<1	<1	1	<1	<1	<1
MGSC	267	380	41	163	421	<1	<1	<1	2	3	3
MRCSP	604	1,308	108	122	143	9	14	26	<1	<1	<1
PCOR*	522	946	305	583	1,012	2	4	9	7	7	7
SECARB	1,022	1,857	1,376	5,257	14,089	27	34	41	33	51	75
SWP	326	779	256	1,000	2,693	144	147	148	<1	1	2
WESTCARB*	162	555	82	398	1,124	4	5	7	11	17	25
Non-RCSP**	53	232	--	--	--	--	--	--	--	--	--
Total	3,071	6,358	2,379	8,328	21,633	186	205	232	54	80	113

Source: U.S. Carbon Storage Atlas –Fifth Edition (Atlas V); data current as of November 2014

* Totals include Canadian sources identified by the RCSP

** As of November 2014, "U.S. Non-RCSP" includes Connecticut, Delaware, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont, and Puerto Rico

*** Medium = p50

P90: 2.6 trillion metric tons CO_2
P10: 22 trillion metric tons CO_2

Source: "DOE's Carbon Storage Atlas – Fifth Edition (Atlas V)"

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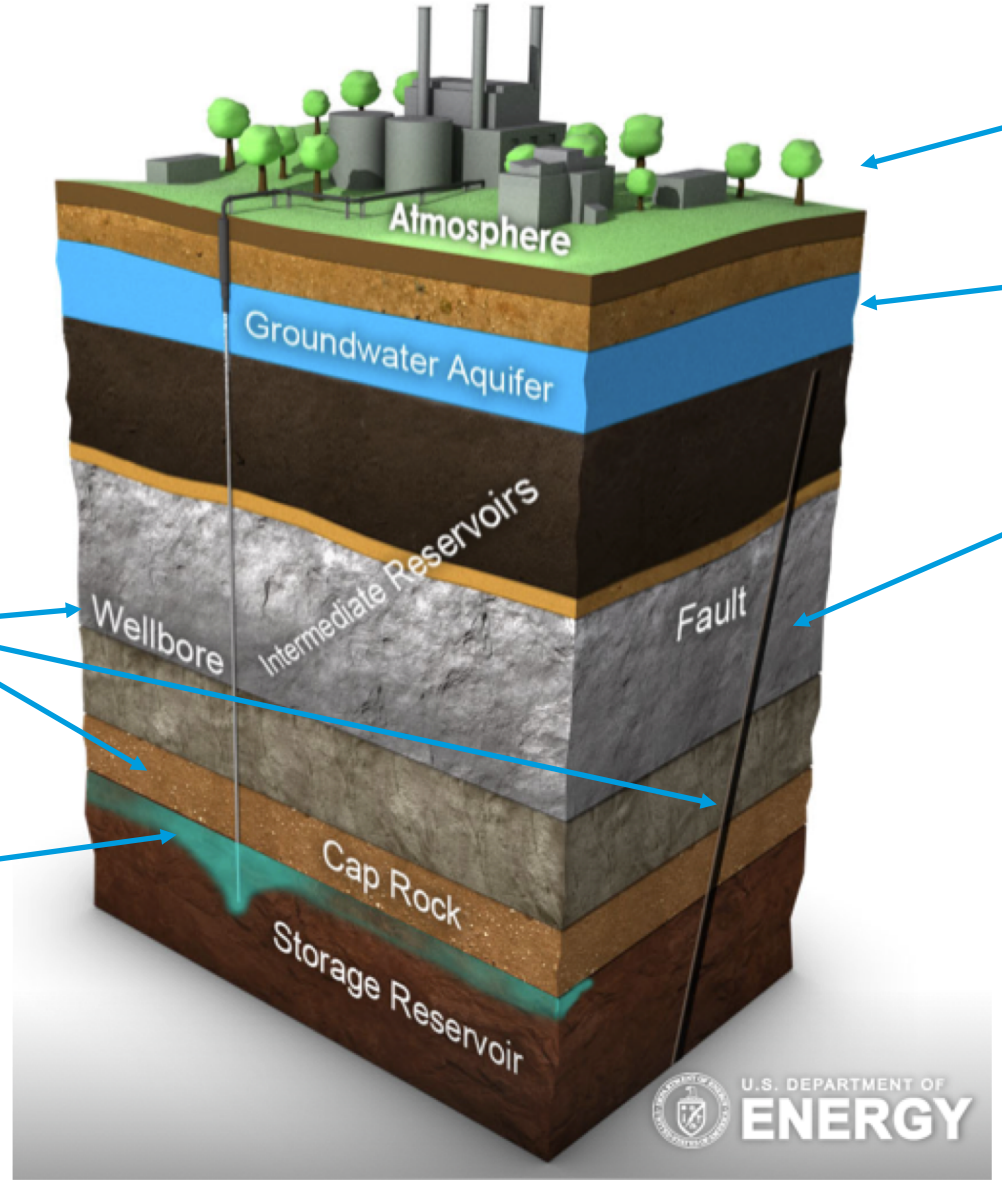
Potential Hazards of GCS



Leakage to Atmosphere

Aquifer Contamination

Induced Seismicity

Leakage Pathways

Injected Plume

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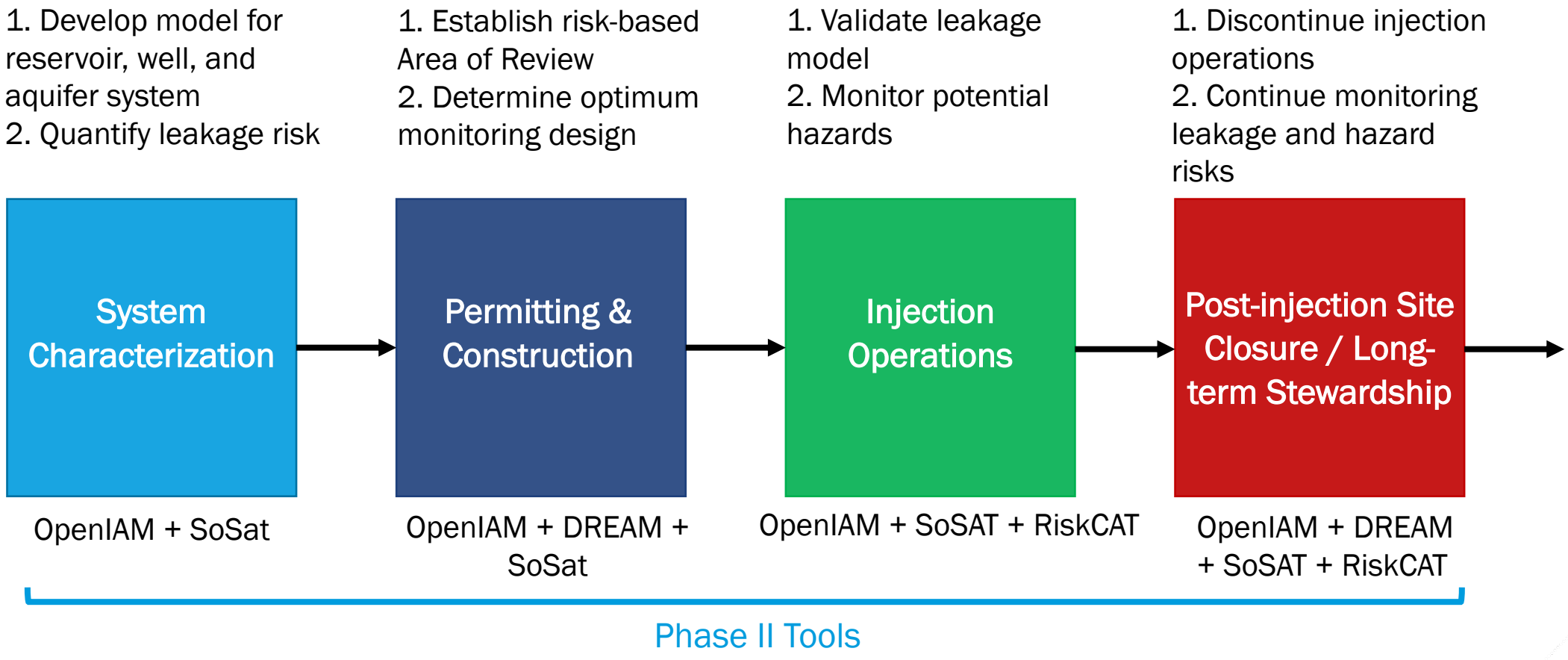
Mission

- The planning of large-scale, long-term GCS projects requires quantitative, science-based methods for estimating long-term environmental risks related to potential leakage and induced seismicity
- NRAP brings together researchers from five DOE national laboratories: NETL, Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, and Pacific Northwest National Laboratory
- Tools developed:
  - Integrated Assessment Model
  - Aquifer Impact Model
  - Ground Motion Prediction for Induced Seismicity
  - Short-Term Seismic Forecasting
  - Probabilistic Seismic Risk Assessment Tool
  - Multiple Source Leakage Reduced-Order Model
  - Reservoir Evaluation and Visualization
  - Reservoir Reduced-Order Model Generator
  - Seal Barrier Reduced-Order Model
  - Well Leakage Analysis Tool
  - Designs for Risk Evaluation and Management
  - State of Stress Assessment Tool

Penn State's Involvement: Workflow Development

Use Case: Risk Assessment for a Reservoir, Wellbore, and Aquifer System



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New Use Case: CO2-EOR field & 45Q tax credits

Passed in February, 2018, the revamped 45Q tax credits give operators $35/ton plus the delivered cost of CO2 (up from $10/ton).

A Proposed New Tool to Help EOR Operators:

- Critical Question: What design of CO2-EOR job is necessary to add financial value to project under 45Q tax credit scheme?
- Workflow: Optimal CO2-EOR design variables
- Case Study: Cranfield, Teapot Dome

Thank You!

Questions? Comments?