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Advisers to the Nation on Science, Engineering, and Medicine

The National Academies Study Process

and a proposed study on

Subsurface Characterization, Modeling, Monitoring, and Remediation of Fractured Porous Rocks

Presentation to the Federal Remediation Technologies Roundtable
November 9, 2010

Sammantha Magsino
National Academies

J. Carlos Santamarina
Georgia Tech

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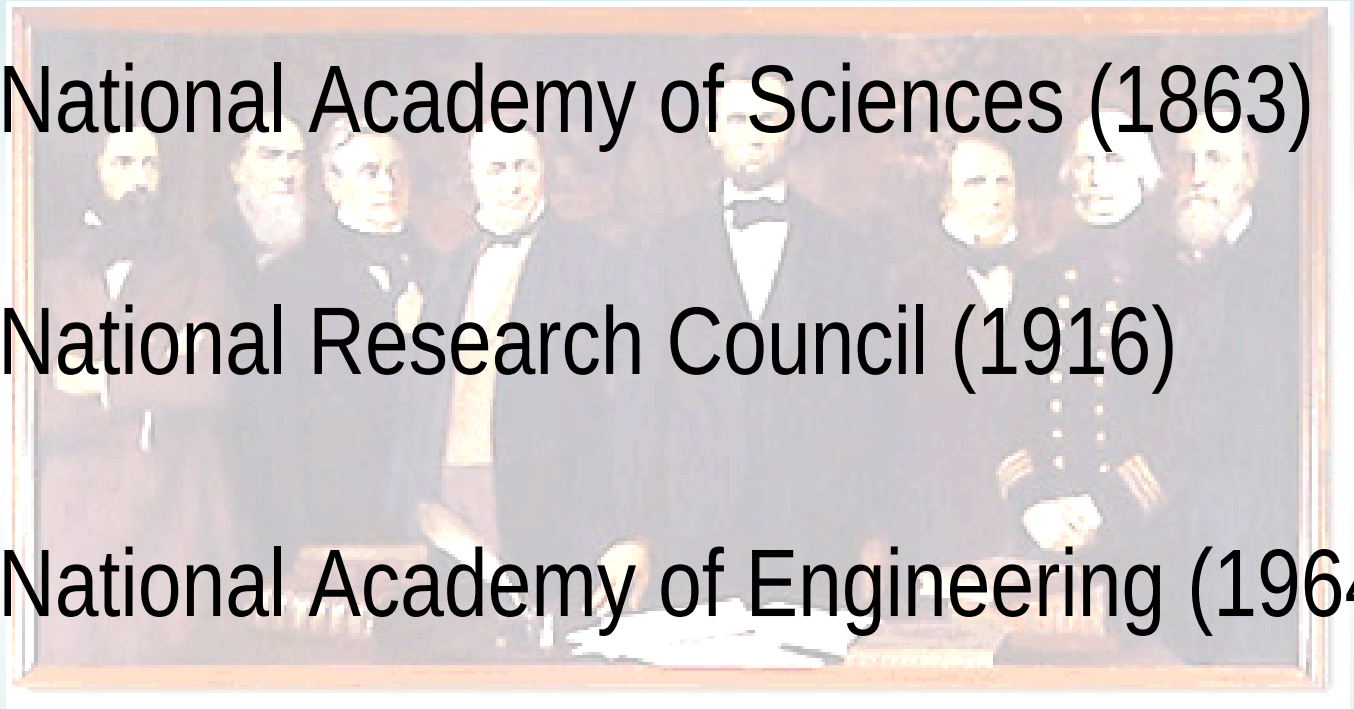
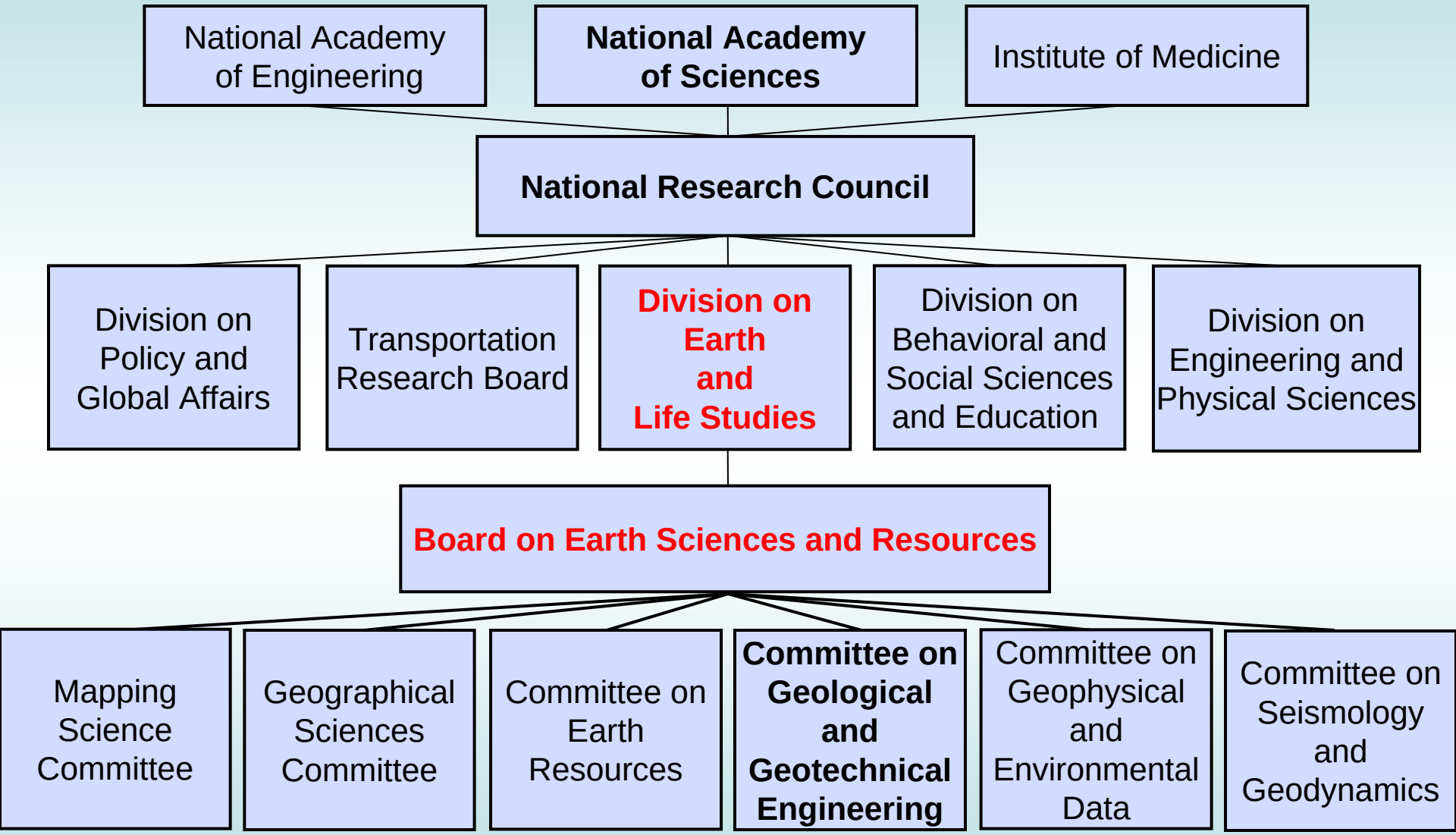


- National Academy of Sciences (1863)
- National Research Council (1916)
- National Academy of Engineering (1964)
- Institute of Medicine (1970)

Abraham Lincoln with the founders of the Academy signing the Academy charter of March 3, 1863. Painting by Albert Herter.

What is COGGE?

Committee On Geological and Geotechnical Engineering


National Academy of Engineering
National Academy of Sciences
Institute of Medicine
National Research Council
Division on Policy and Global Affairs
Transportation Research Board
Division on Earth and Life Studies
Division on Behavioral and Social Sciences and Education
Division on Engineering and Physical Sciences
Board on Earth Sciences and Resources
Mapping Science Committee
Geographical Sciences Committee
Committee on Earth Resources
Committee on Geological and Geotechnical Engineering
Committee on Geophysical and Environmental Data
Committee on Seismology and Geodynamics

COGGE Members

- Edward Kavazanjian, Jr. (Chair) *Arizona State University*
  Department of Civil and Environmental Engineering
- Conrad W. Felice
  C.W. Felice, LLC
- Murray W. Hitzman *Colorado School of Mines*
  Department of Geology and Geological Engineering
- Sandra Houston *Arizona State University*
  Department of Civil and Environmental Engineering
- Wesley C. Patrick *Southwest Research Institute*
  Geosciences and Engineering Division
- J. Carlos Santamarina *Georgia Institute of Technology*
  School of Civil and Environmental Engineering

Past Chair

- Gregory B. Baecher, *University of Maryland*
  Department of Civil and Environmental Engineering

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COGGE Mission Statement

- To identify, investigate, and report on questions relating to geological and geotechnical engineering to government, industry, academia, and the public;
- To inform public policy on geological and geotechnical engineering issues;
- To identify new technologies and potential applications; and
- To promote the acquisition and dissemination of knowledge.

Types of Activities

- Consensus reports
- Symposia, roundtables, and forums on national issues
- Proceedings from conferences and workshops
- “White papers” that take a stand on pressing scientific concerns

COGGE Sponsors

- National Science Foundation
- US Nuclear Regulatory Commission
- NIOSH Mining Safety and Health Research Program

Past and Present Study Sponsors

FEMA, EPA, NSF, USNRC, DoD, DoE, BLM, Bureau of Reclamation, FHWA, Gas Research Institute, Dowell-Schlumberger, Inc.

Current Activities

Current Studies

- Underground Engineering for Sustainable Development
- Integrating Dam and Levee Safety and Community Resilience
- Induced Seismicity in Energy Applications

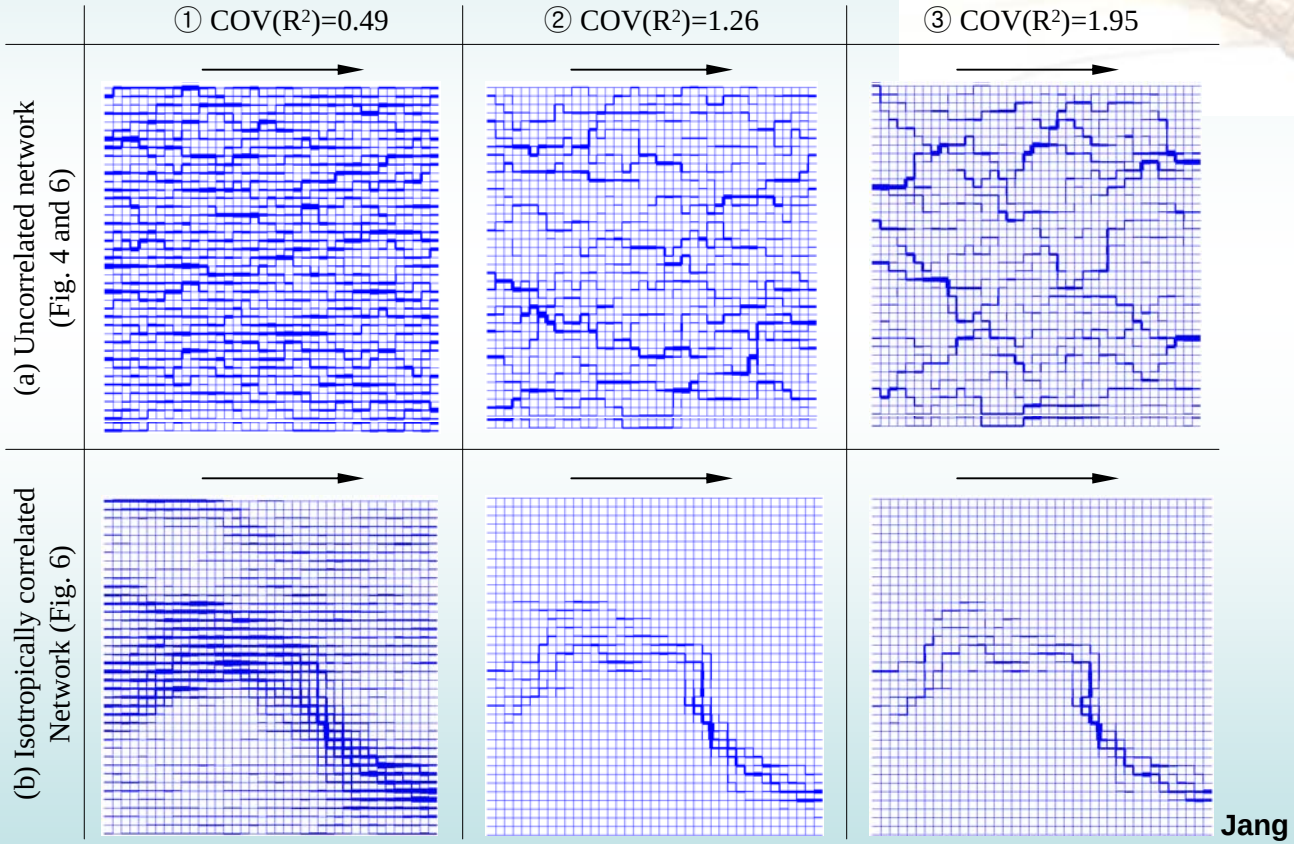
In Development

- The Role of Geotechnology in Sustainable Energy Production
- Criteria for Liquefaction Susceptibility Assessment

Today's topic

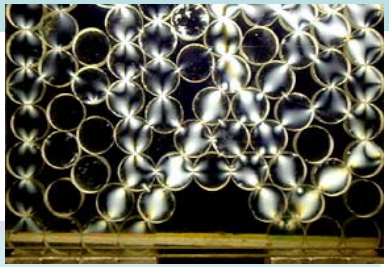
Subsurface Characterization, Modeling, Monitoring, and Remediation of Fractured Porous Rocks

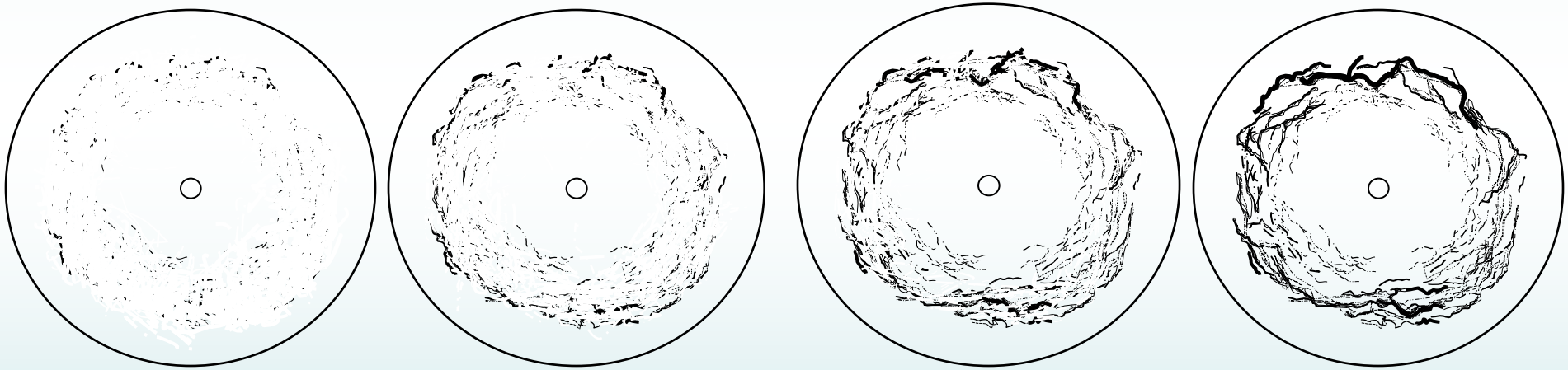
Spatial Variability



Jang

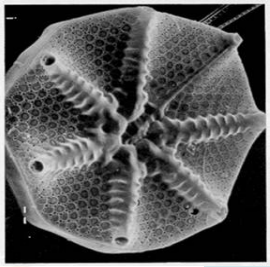
Fines Migration



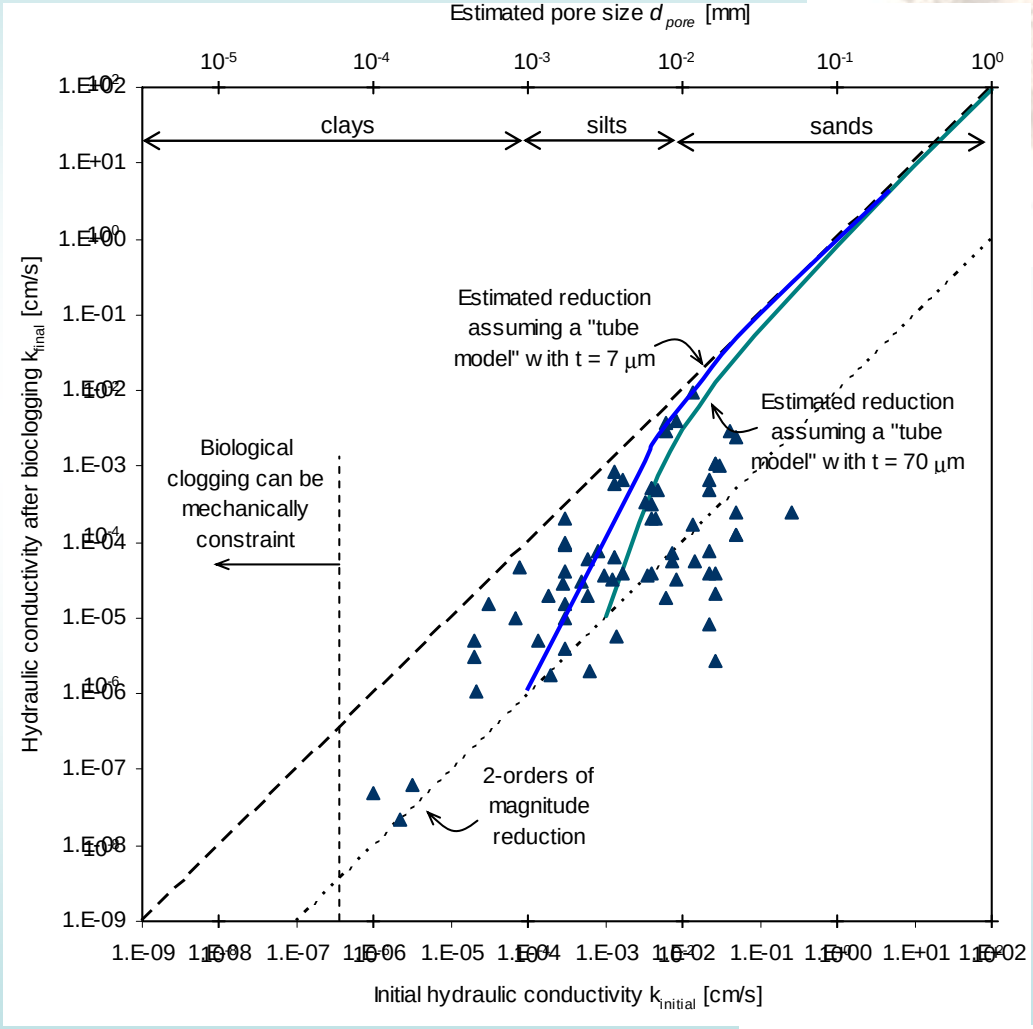


Valdes

Hydro-Biological



The diatoms - 1990



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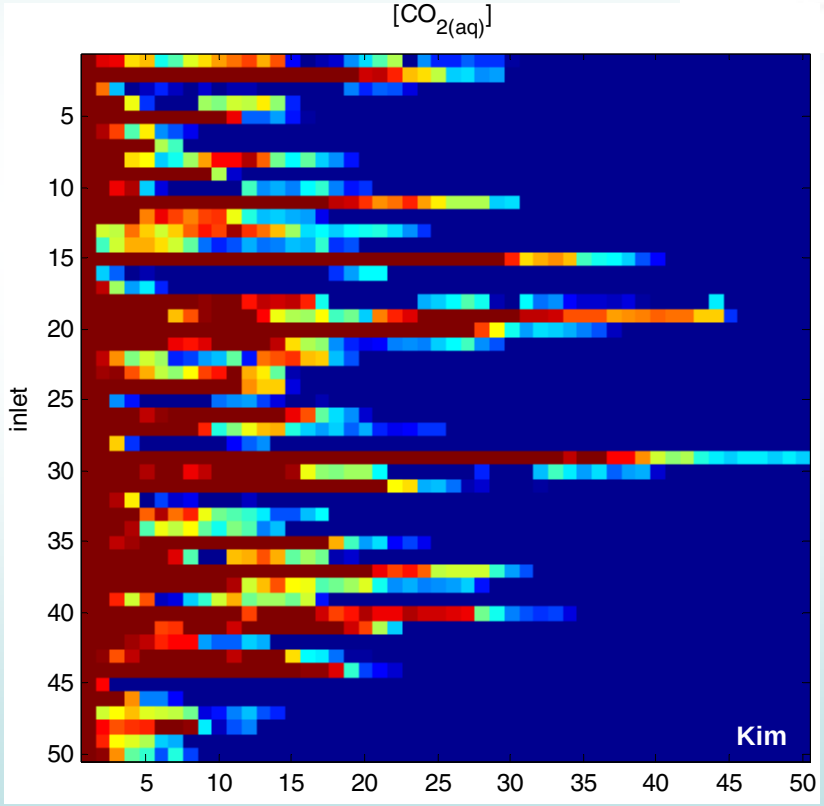
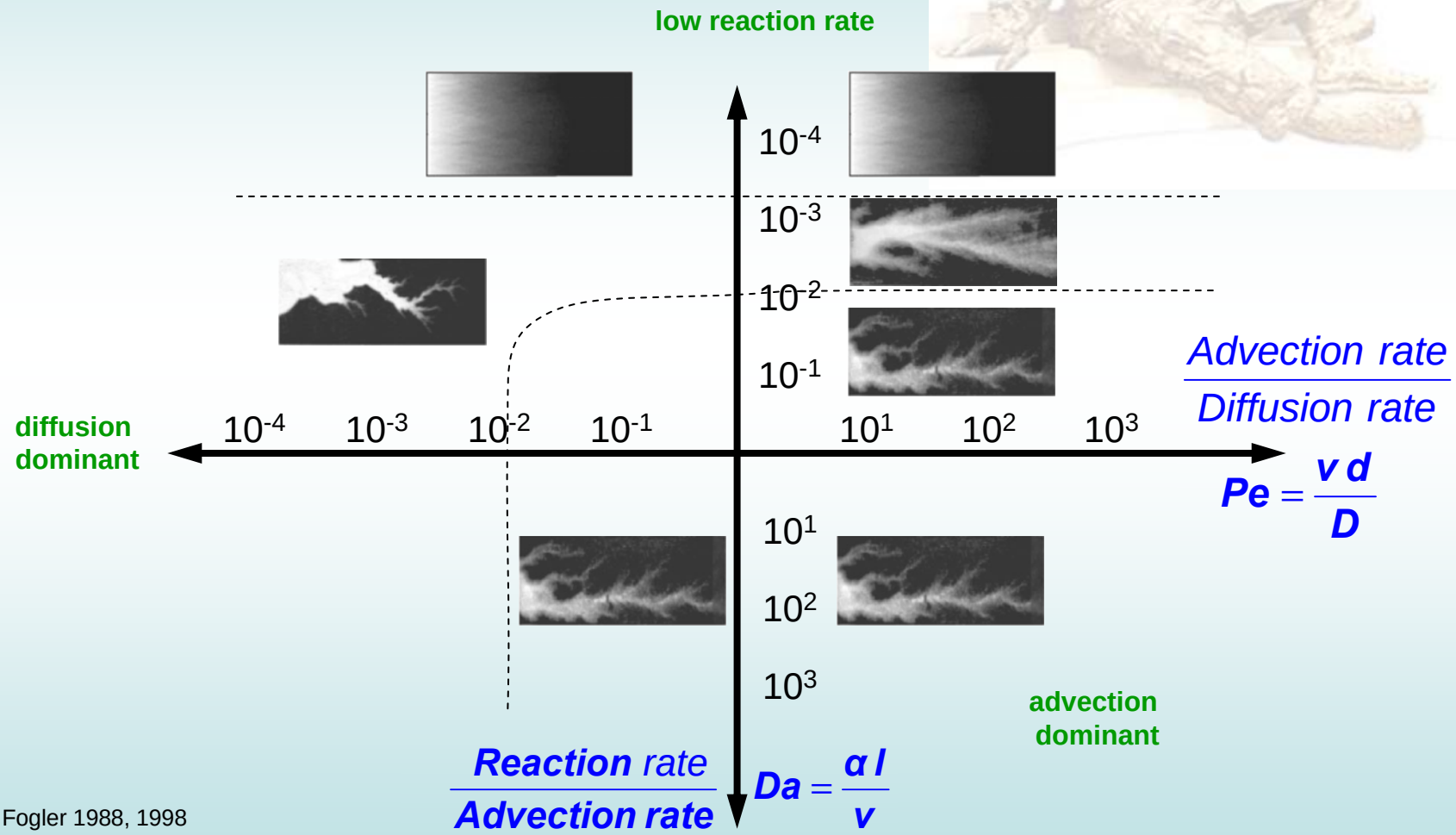
Reactive Fluid Transport

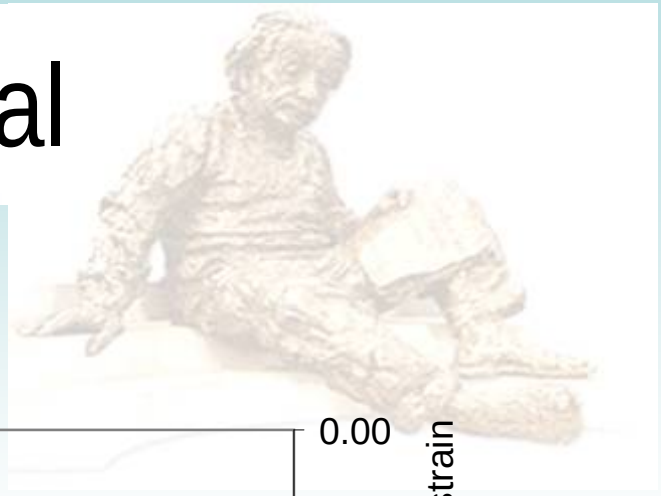


Advection-Diffusion-Reaction

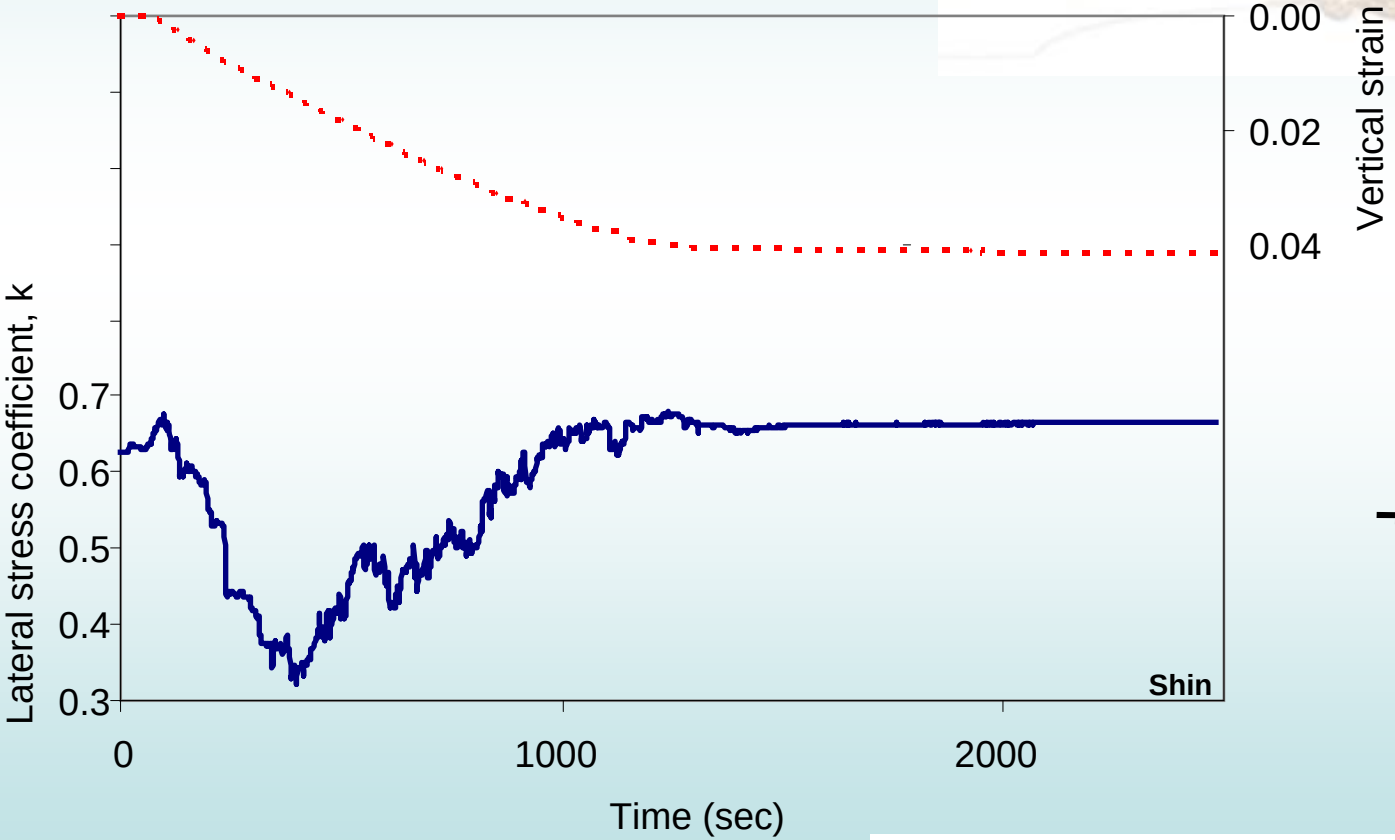


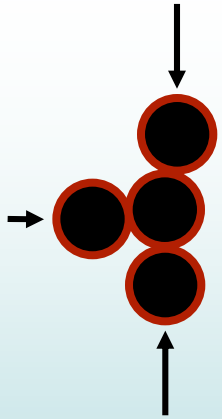
Fredd & Fogler 1988, 1998
Fredd & Miller's 2000
Golfier et al. 2002

Hydro-Chemo-Mechanical



90% glass bead + 10% NaCl





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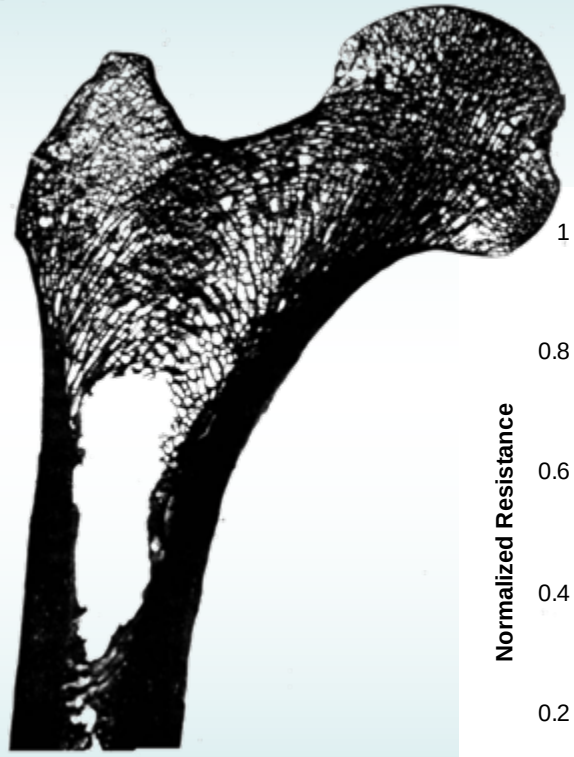
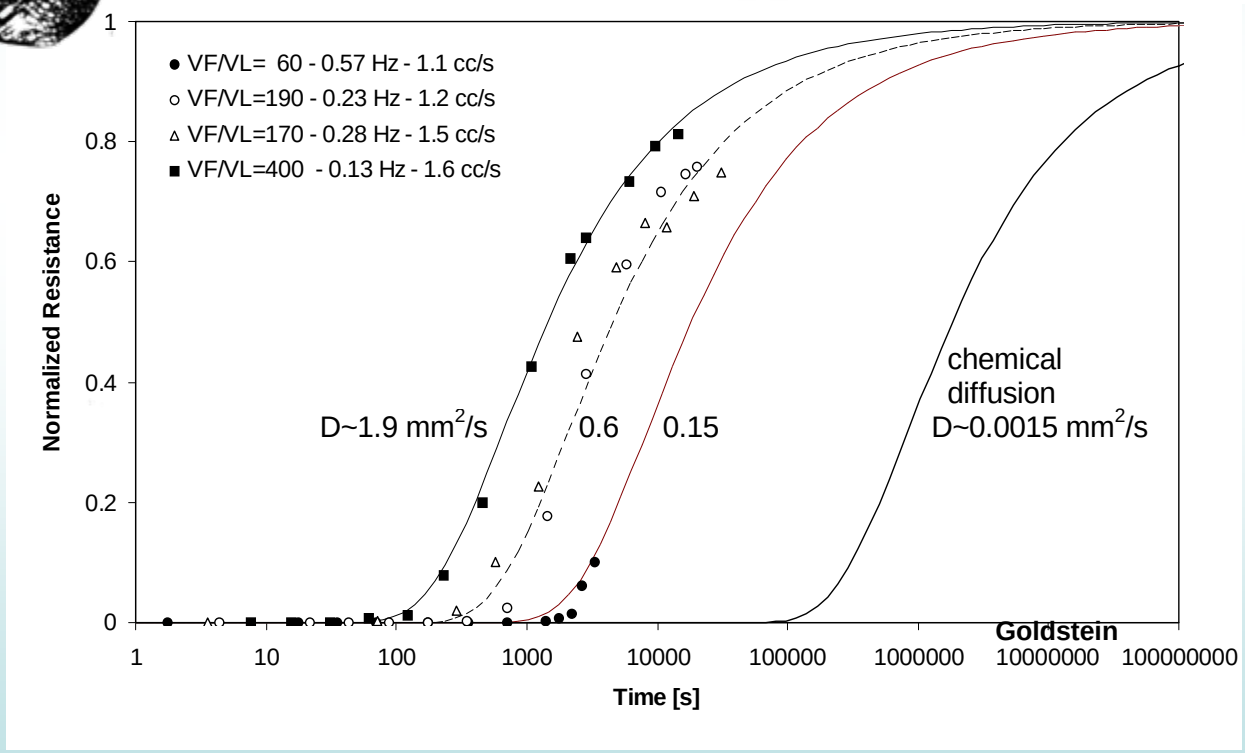
Cyclic Stress: AC Advection





Study Objectives

Plan and hold a workshop to examine state-of-the-art in

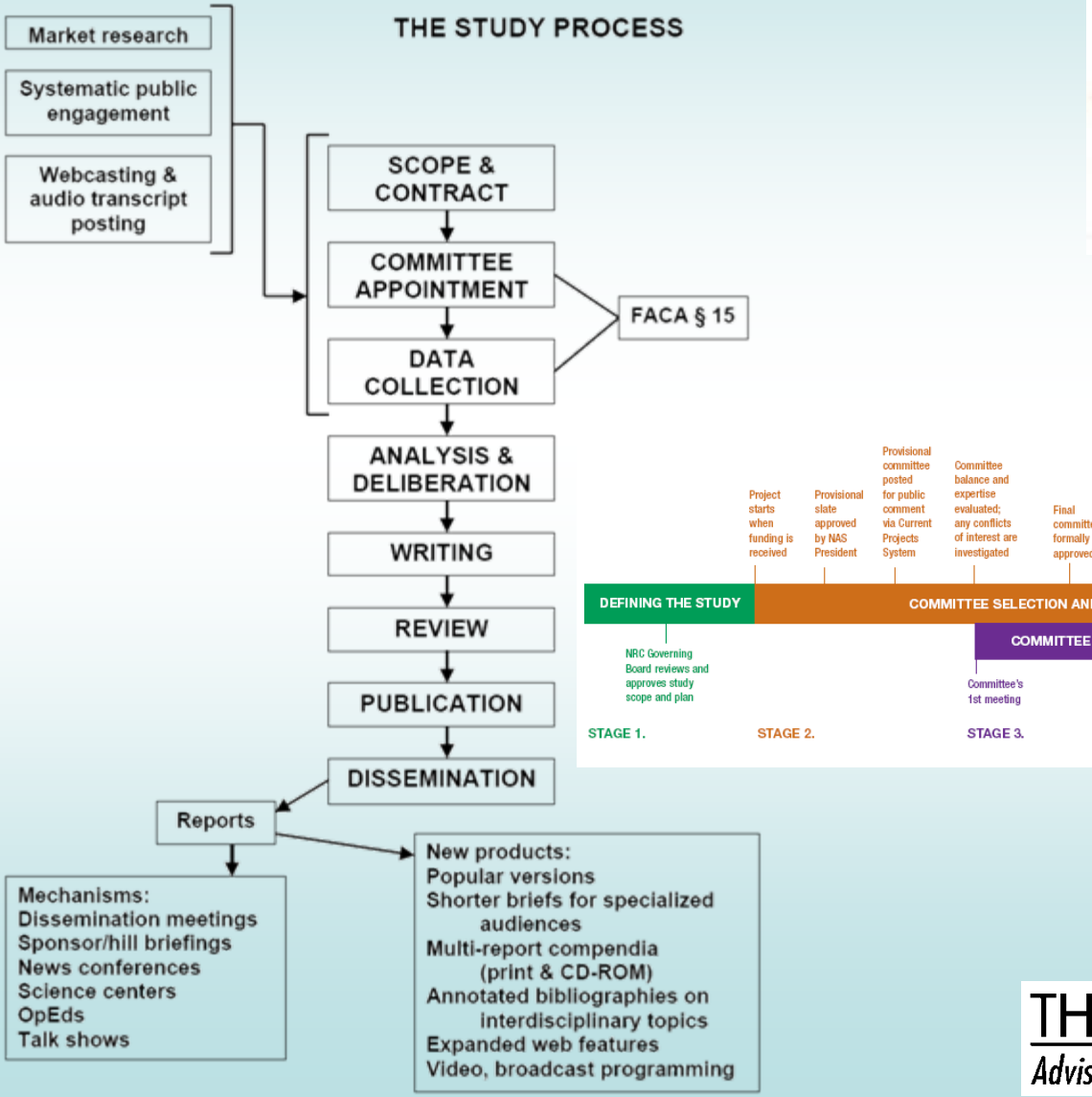
- Subsurface fracture and matrix characterization and the development of conceptual models
- Detection of fluid and contaminant pathways and travel times
- Detection and modeling of factors that affect change in geotechnical and hydrological properties over time
- Groundwater and contaminant transport modeling, monitoring, and remediation and how these can aid decision making during the lifecycle of a facility
- Early indicators of system failure resulting in unintentional fluid release
- Potential mitigation measures to eliminate or reduce system failure

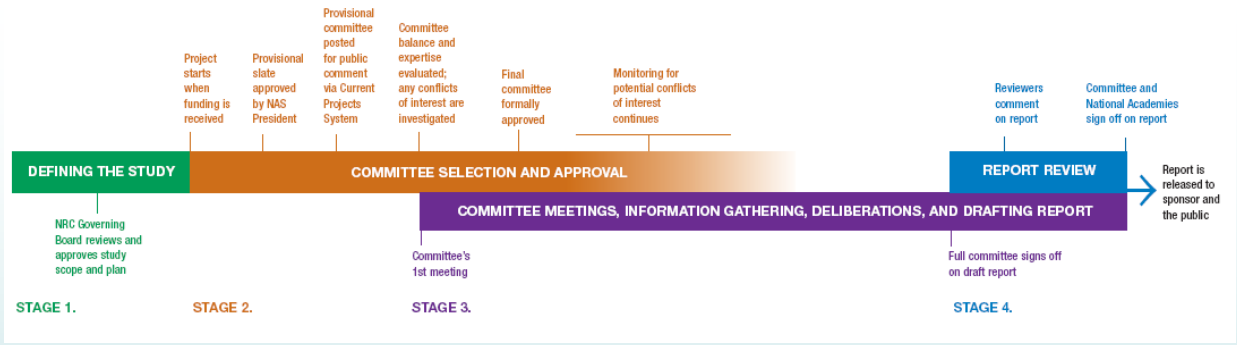
Findings and Conclusions

A final report will be issued that will discuss

- Where research and development could improve the current state of the art
- Where incorporation of scientific and technical advances could enhance the state-of-practice and inform federal regulations and implementing guidelines
- Other areas identified by partnering sponsors

Study Process





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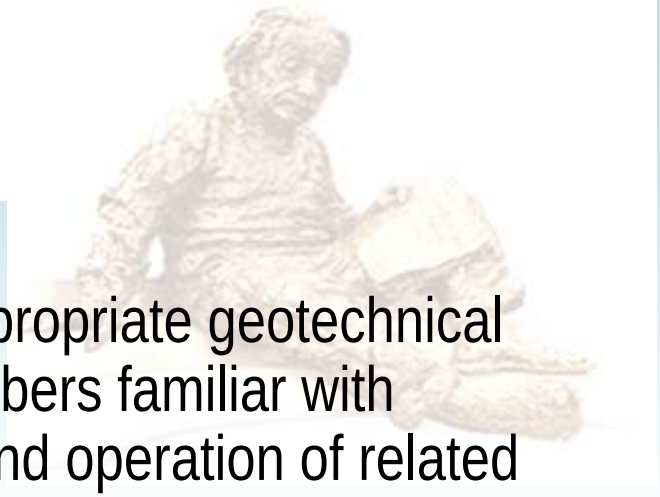
NA Committee Selection

- Nominations sought from many sources
- Staff interview candidates
  - well balanced
  - free from conflicts of interest
  - range of expertise

All reports undergo extensive internal and external review

Study Logistics



- 10 committee members, expertise in appropriate geotechnical and geohydrological disciplines plus members familiar with related statutes and regulations, design and operation of related facilities, remediation practices, and current public concerns.
- 19 month activity
  - Once contract in place, committee selected and approved
  - Committee holds workshop and 3 meetings over a 12-month period
  - Report enters review at 12 months
  - Prepublication version of report released at 15 months
  - Final version of report becomes available at 19 months