



# AGENDA

**April 11 ~ 15, 2022**

**Energy Geosciences Division  
Lawrence Berkeley National Laboratory  
Berkeley, California**

**Instructors**  
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\*Times are Pacific time, with potential to be adjusted based on the major of the participants region.

## Monday, April 11, 2022

*1:00 pm Welcome, Introduction, Safety*

*1:15 pm Introduction*

- Modeling and Course objectives
- TOUGH history and applications

*1:45 pm Computer Setup & Coffee Break*

*2:00 pm Review of Multiphase Flow*

- Phases, components, phase transitions, governing equations, fluid and porous-medium properties, equation of state, non-isothermal and other processes

*3:00 pm Break*

*3:10 pm Continue: Review of Multiphase Flow*

*4:00 pm Numerical Methods in TOUGH*

- Integral finite difference method, space and time discretization, Newton-Raphson iterations, linear equation solvers, weighting schemes

*5:00 pm Adjourn*

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## Tuesday, April 12, 2022

1:00 pm *TOUGH Overview*

- Capabilities, code architecture, basic input and output concepts

1:30 pm *Building a TOUGH Model (coffee break between)*

- Material properties (Problem 1a)
- Mesh generation (Problem 1b)
- *TOUGH I/O web application*
- Initial and boundary conditions (Problem 1c)

5:00 pm *Adjourn*

## Wednesday, April 13, 2022

1:00 pm *Continue – Building a TOUGH Model*

- Computational parameters (Problem 1d)
- Explore (e.g., Problem\_OneElement, EOS 9 for problem 1, and comparison with EOS3)
- *Q/A*

3:00 pm *Fractured Rocks*

3:30 pm *Break*

3:45 pm *TOUGH3 features*

4:00 pm *Phase Change in a Non-isothermal Two-Phase, Two-Component System*

- Hands-on computer exercise (Problem PC)
- Primary variables, initialization, variable switching

5:00 pm *Adjourn*

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## Thursday, April 14, 2022

*1:00 pm Injection of CO<sub>2</sub> in a Saline Aquifer*

- Introduction to CO<sub>2</sub> sequestration related EOS
  - Introduction to ECO2N
  - Hands-on computer exercise (Problem ECO2N)
  - Non-isothermal simulation
  - Variable injection rate
  - Permeability reduction due to salt precipitation
  - Post-injection period: pressure recovery and phase redistribution
  - Effect of relative permeability functions
  - Introduction to hysteresis
  - Hands-on computer exercises, including quick-and-dirty plotting with Excel
- (Coffee break between)

*5:00 pm Adjourn*

## Friday, April 15, 2022

*1:00 pm Model Tracer Tests in a Geothermal Reservoir*

- Introduction to EOS1 for modeling geothermal reservoir
  - Hands-on computer exercise
  - Problem variation
- (Coffee break between)

*4:00 pm Q/A*

*6:00 pm Adjourn*

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