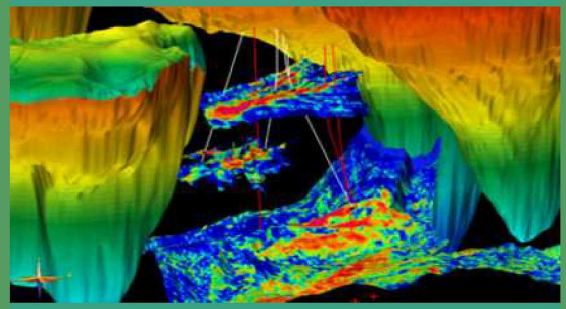
SAND2019-13170PE

Geosciences Research & Applications: Center 8860



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Giorgia Bettin

Department of Geothermal Research

EARTH SCIENCE IS EMBEDDED IN Sandia's five missions

Understand nano-microscale to the macroscale, multi-physics view of the earth and its processes and climate change monitoring, modeling and geo-engineering

Emergency response activities for the Department of Homeland Security, nuclear waste disposal, geothermal energy and Fossil Energy production and optimization, managing deep subsurface energy storage

t readiness and weapon to osphere, ocean and solid Earth raction

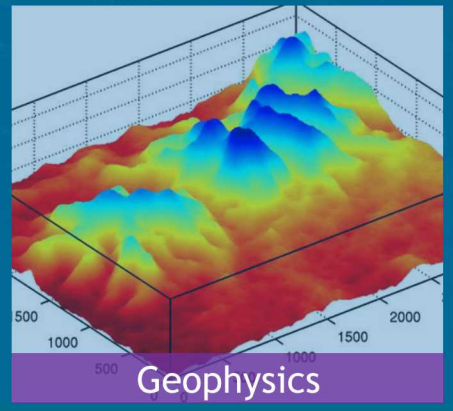
und-based nuclear detonation ection, determination of losive yield and burial ditions, and proliferation essments

ect and Characterize erground structures and support ective countermeasure planning; floor characterization; energy vesting and sonar accuracy

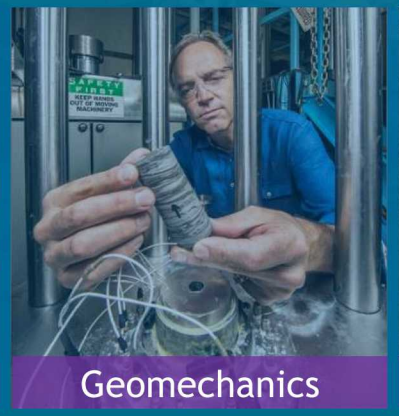
Quantitative Geoscience - bridging field geology understanding with advanced in-situ sensing, interpretation and simulation tools


Atmospheric Sciences

Geotechnologies



Geophysics


Geomechanics


Geochemistry

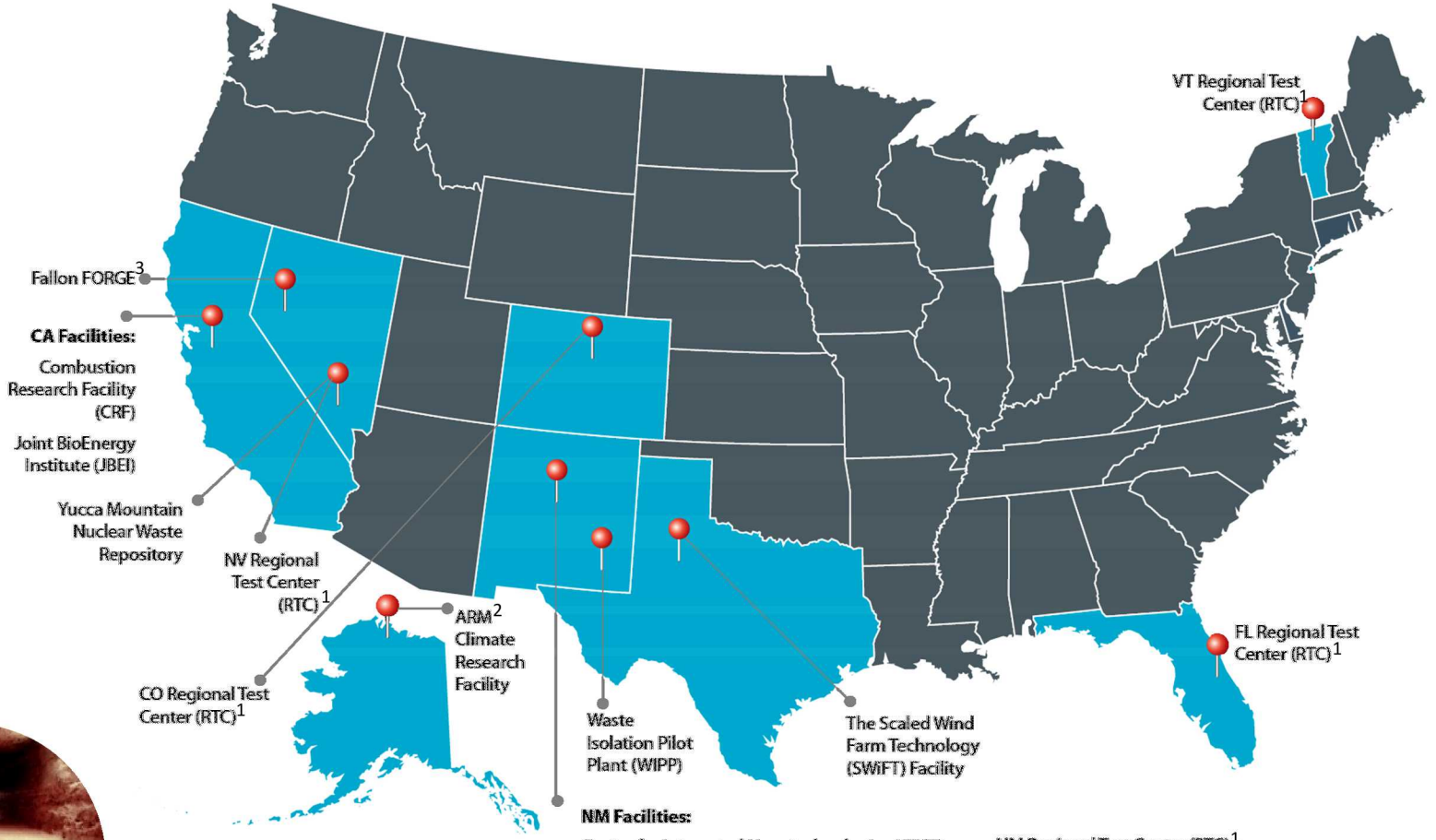

Geothermal

Our Energy Facilities

FORGE

Brayton Cycle Lab

Waste Isolation Pilot Plant (WIPP)



NM Facilities:

- Center for Integrated Nanotechnologies (CINT)
- Distributed Energy Technologies Lab (DETL)
- Photovoltaic Systems Evaluation Lab (PSEL)
- Control & Optimization of Networked Energy Technologies (CONET)
- Battery Abuse Testing Laboratory (BATLab)

- NM Regional Test Center (RTC)[1]
- National Solar Thermal Test Facility (NSTTF)
- Geomechanics Lab
- Brayton Cycle Lab
- National Infrastructure Simulation & Analysis Center (NISAC)

National Solar Thermal Test Facility (NSTTF)

Geomechanics Lab

The Scaled Wind Farm Technology (SWiFT) Facility

ARM Climate Research Facility

[1] Regional Test Centers (RTCs) provide high fidelity testbeds for US solar companies to evaluate their technologies in varied climates.
[2] The Arctic Radiation Measurement (ARM) Climate Research Facility supports climate modeling, search & rescue operations, and other national security work.
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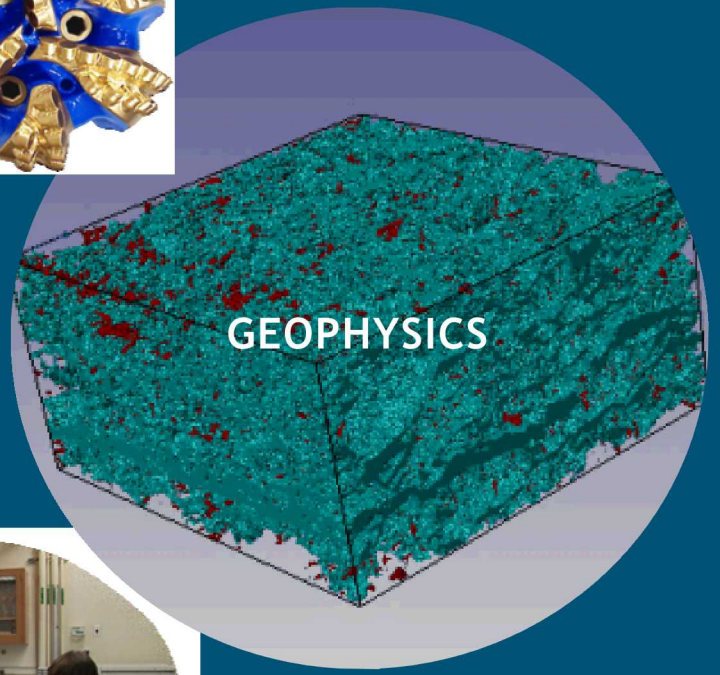
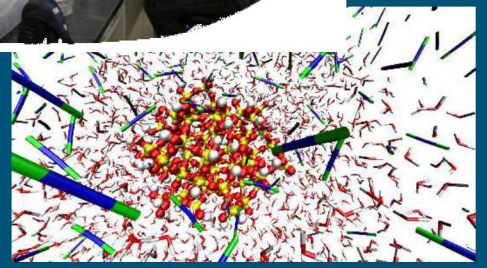
Geoscience Research Capabilities

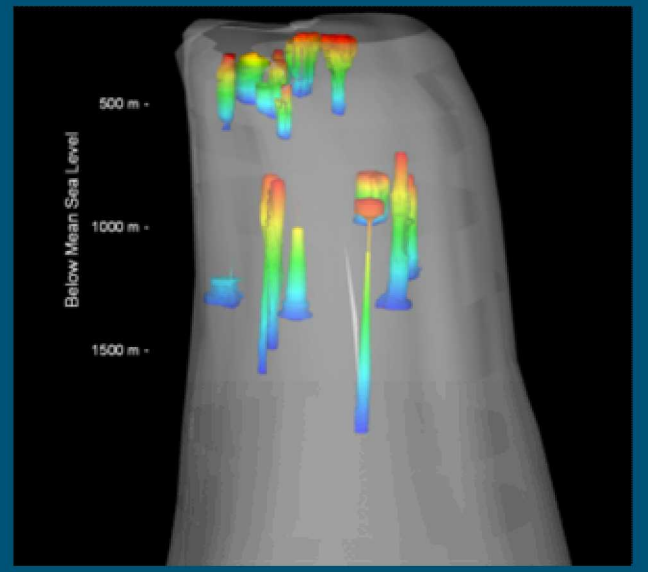
Drilling technologies, adverse environment access and, subsurface tools



Coupled geomechanics, geochemistry and geophysics across multiple scales



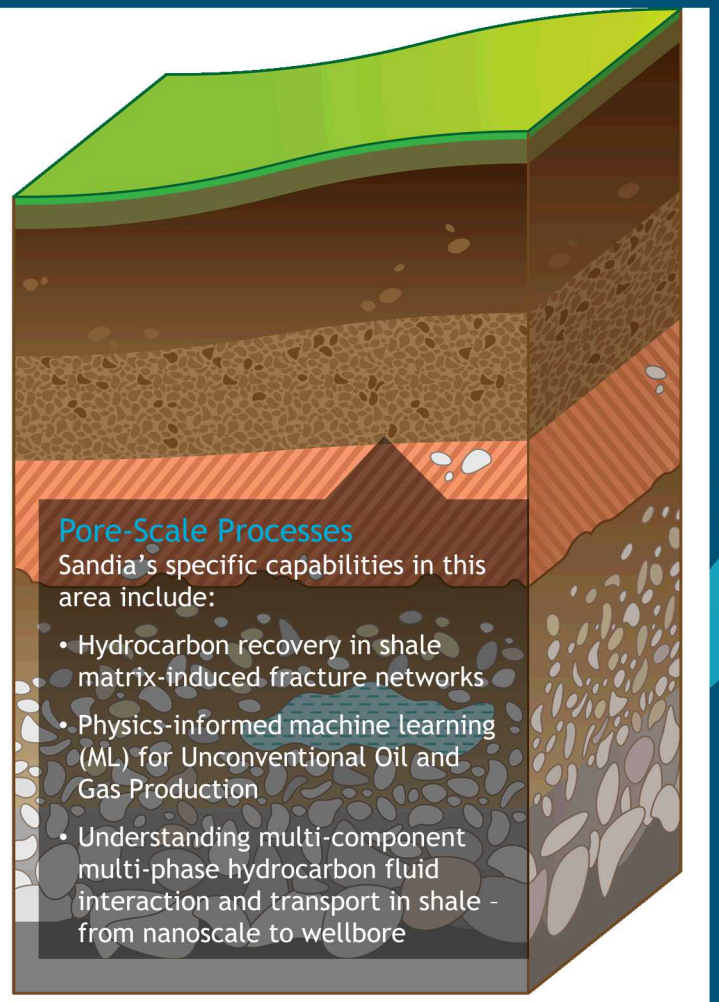
Geochemistry Labs & Dynamics Modeling



Salt mechanics modeling, Oil Chemistry and Spatial Statistics

Molecular to Core to Reservoir Scale R&D

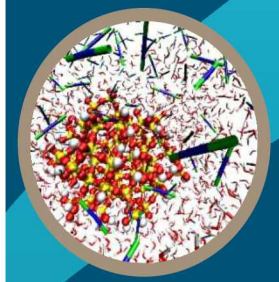
Our Research and Development Spans Multiple Scales

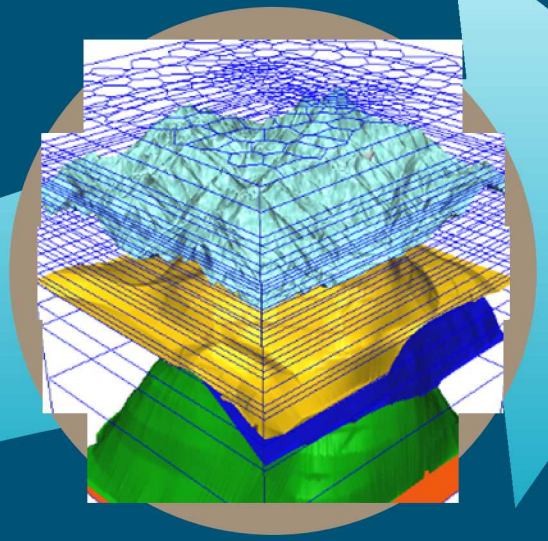


Pore-Scale Processes

Sandia's specific capabilities in this area include:

- Hydrocarbon recovery in shale matrix-induced fracture networks
- Physics-informed machine learning (ML) for Unconventional Oil and Gas Production
- Understanding multi-component multi-phase hydrocarbon fluid interaction and transport in shale - from nanoscale to wellbore





Lab Capabilities

Geomechanics Laboratory

Large rock mechanics laboratory with multiple servo-controlled triaxial test systems (rated to 1 GPa and 400 MPa hydrostatic pressure). Measurements of permeability, ultrasonic velocity, and full waveform acoustic emission parameters can be performed concurrently. A temperature-controlled creep room houses additional systems for long term triaxial creep experiments (as low ~10^{-11} s^{-1}).

Geotechnology Laboratory

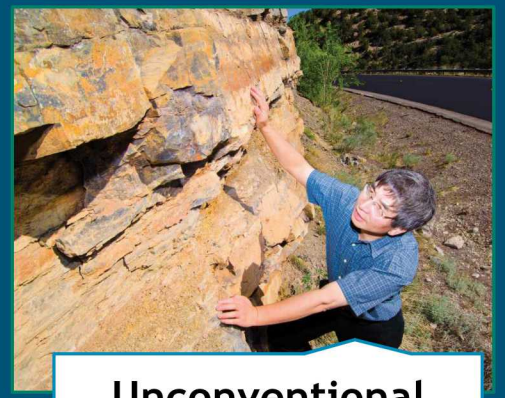
The Geotechnology Laboratory includes High pressure/high temperature equipment, Coretest with flow through capability to pressures of 15kpsi and temperatures to 450°C. Three core holders are triaxial with 15,000 psi load capability. One is set up for triaxial tests with in situ X-Ray CT imaging. Another is affixed with ultrasonic transducers for measuring axial P- and polarized S wave transmission and pulse-echo.

Cement Fabrication Laboratory

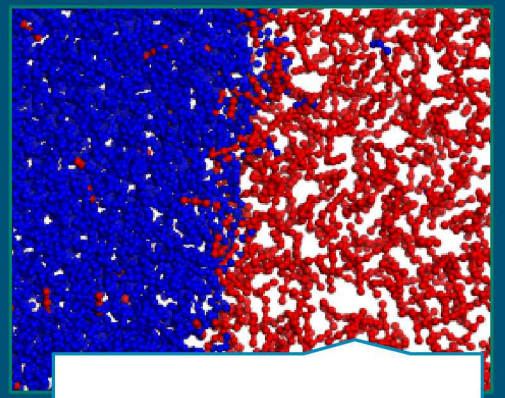
Houses equipment and facilities for preparing cement samples of various geometries. A variety of ovens permit a range of curing conditions with humidity and vibration, and triaxial core holder cells with heating jackets are available for curing under hydrostatic and non-hydrostatic pressure conditions.

Fossil Energy: Oil and Gas Technology and Engineering

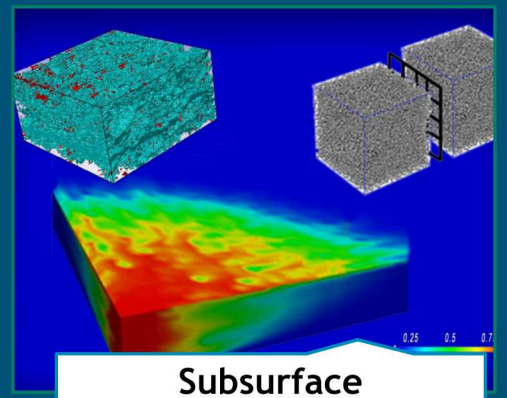
Our Fossil Energy Research Themes



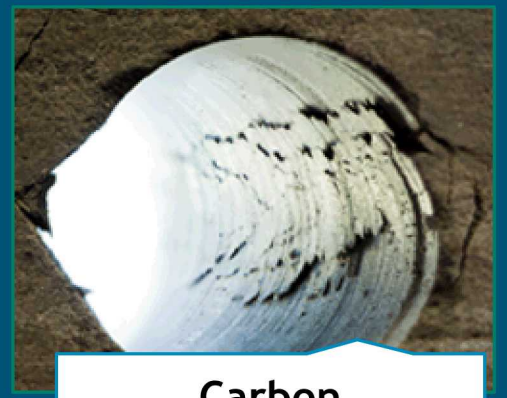
Unconventional Shale Science



Subsurface Integrity



Subsurface Characterization & Engineering

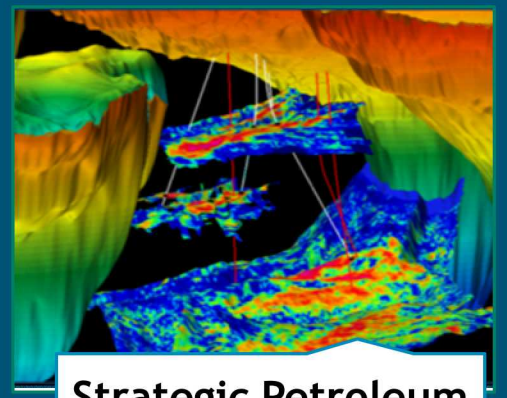


Carbon Sequestration

Geophysics

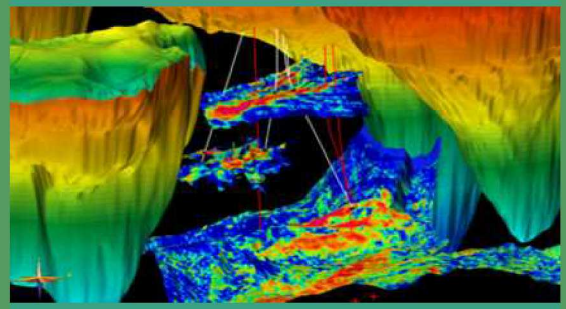
Drilling Technology & Downhole Tools

Safe Oil & Gas Transport



Strategic Petroleum Reserve

SUBSURFACE TECHNOLOGIES



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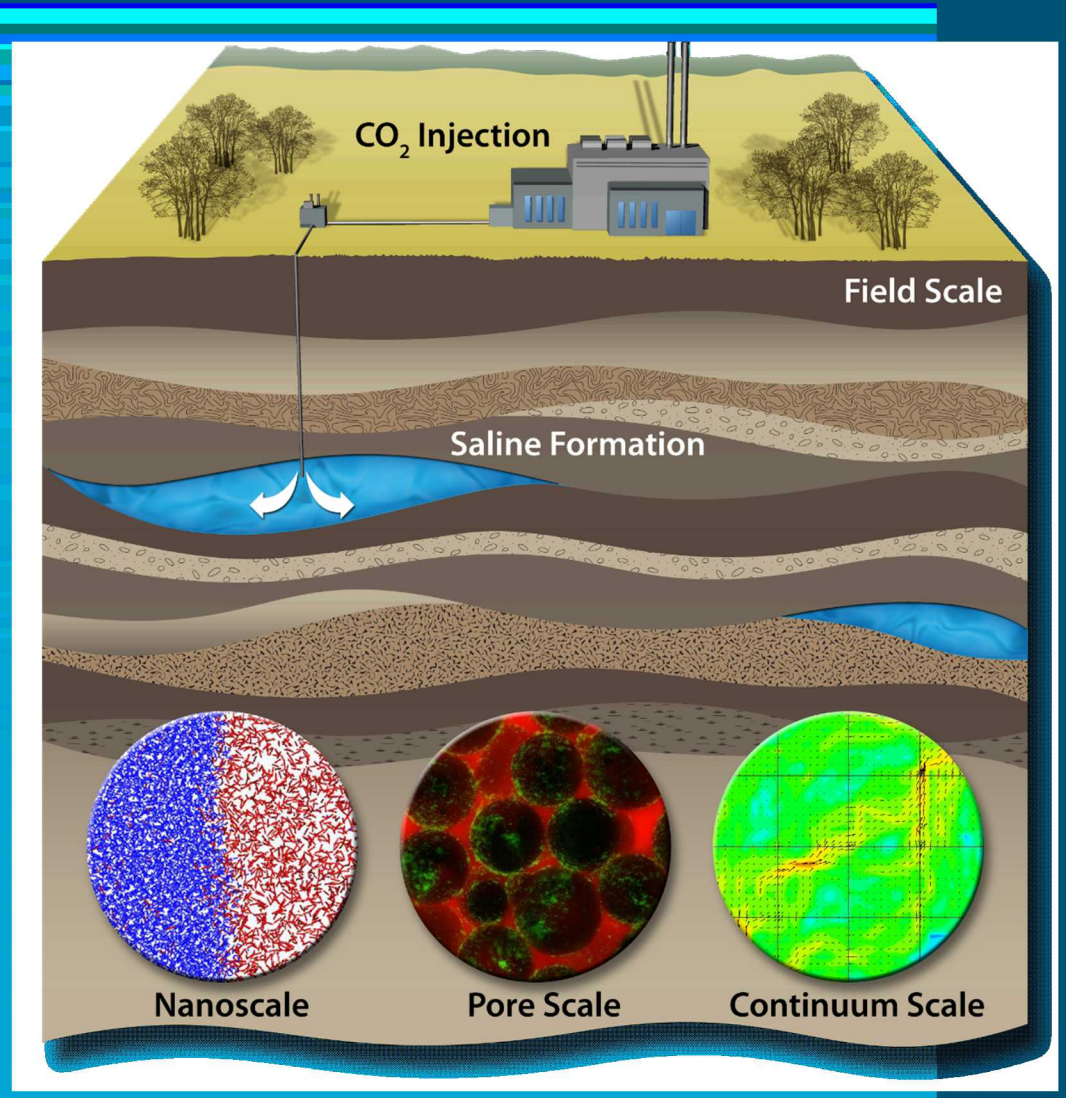
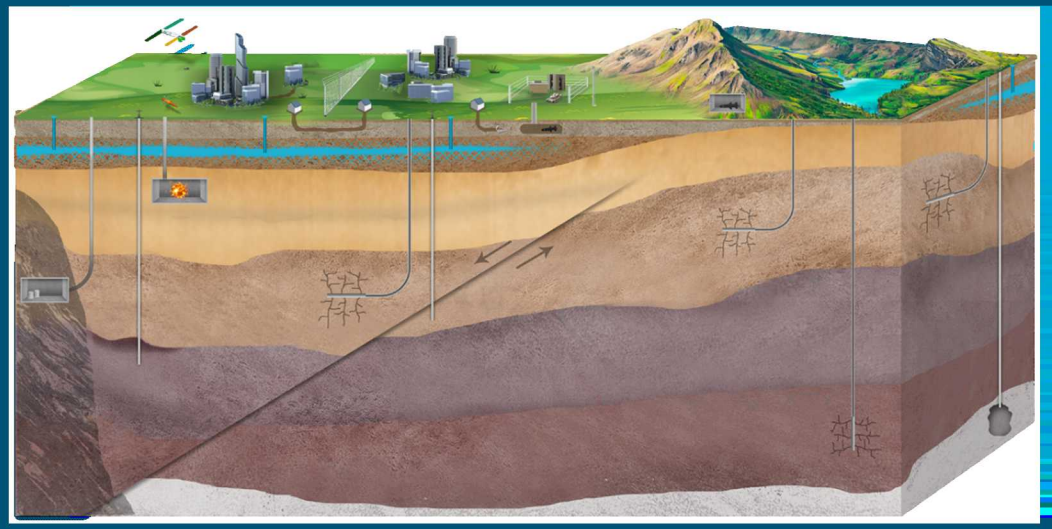
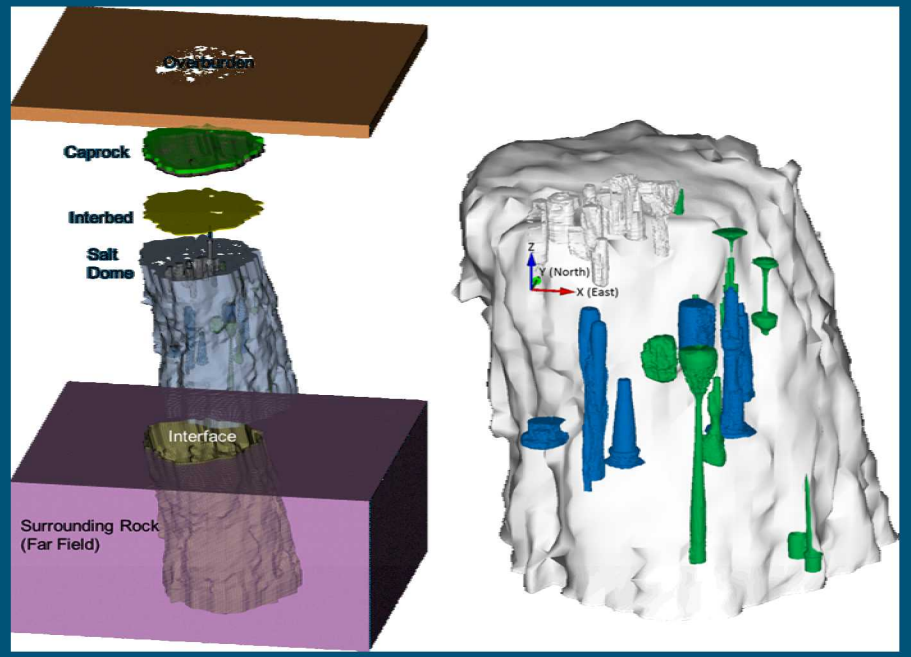
Sandia National Laboratories is a multimission laboratory managed and operated by National Technology and Engineering Solutions of Sandia LLC, a wholly owned subsidiary of Honeywell International Inc. for the U.S. Department of Energy's National Nuclear Security Administration under contract DE-NA0003525.

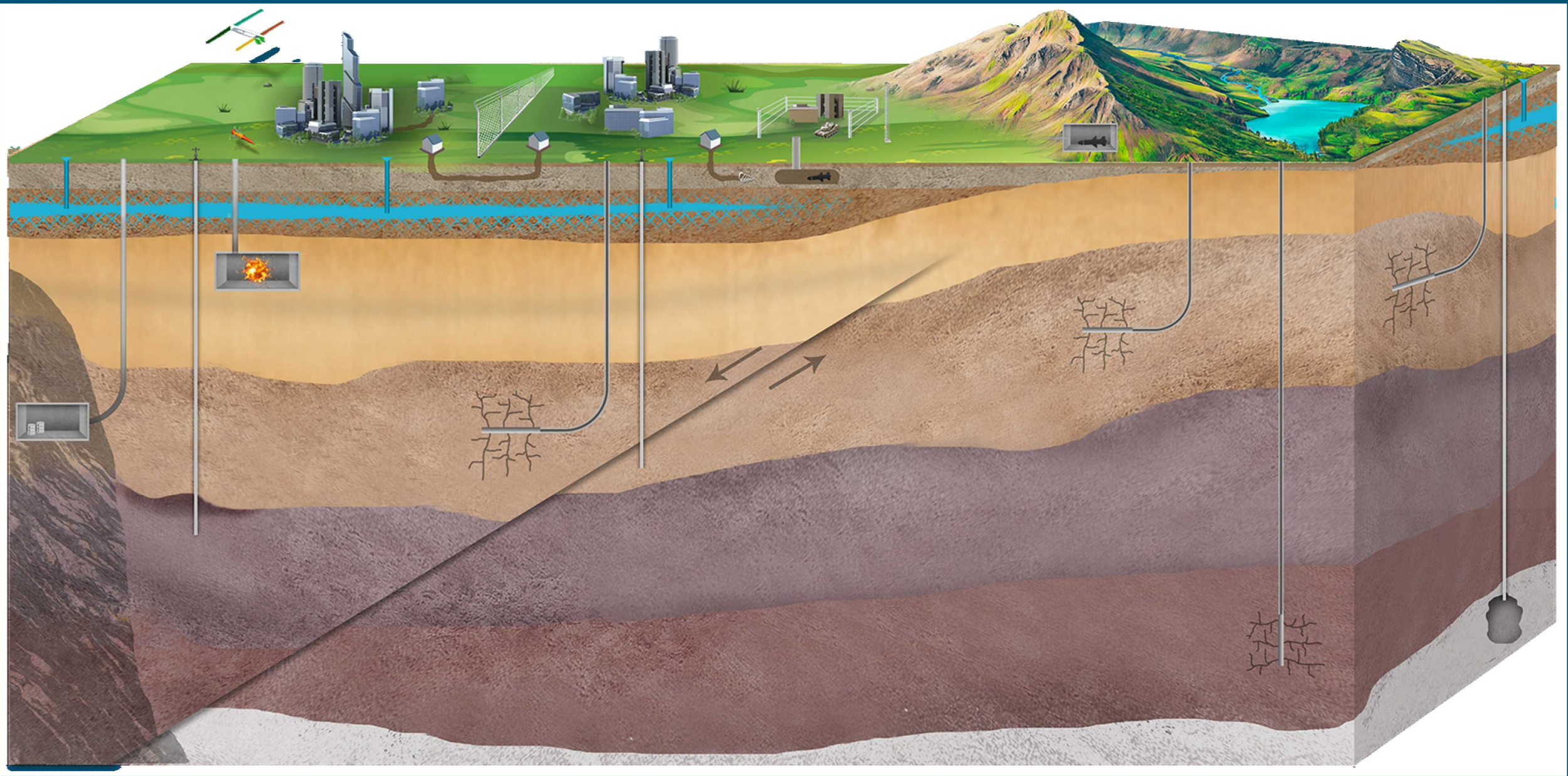
Subsurface Characterization

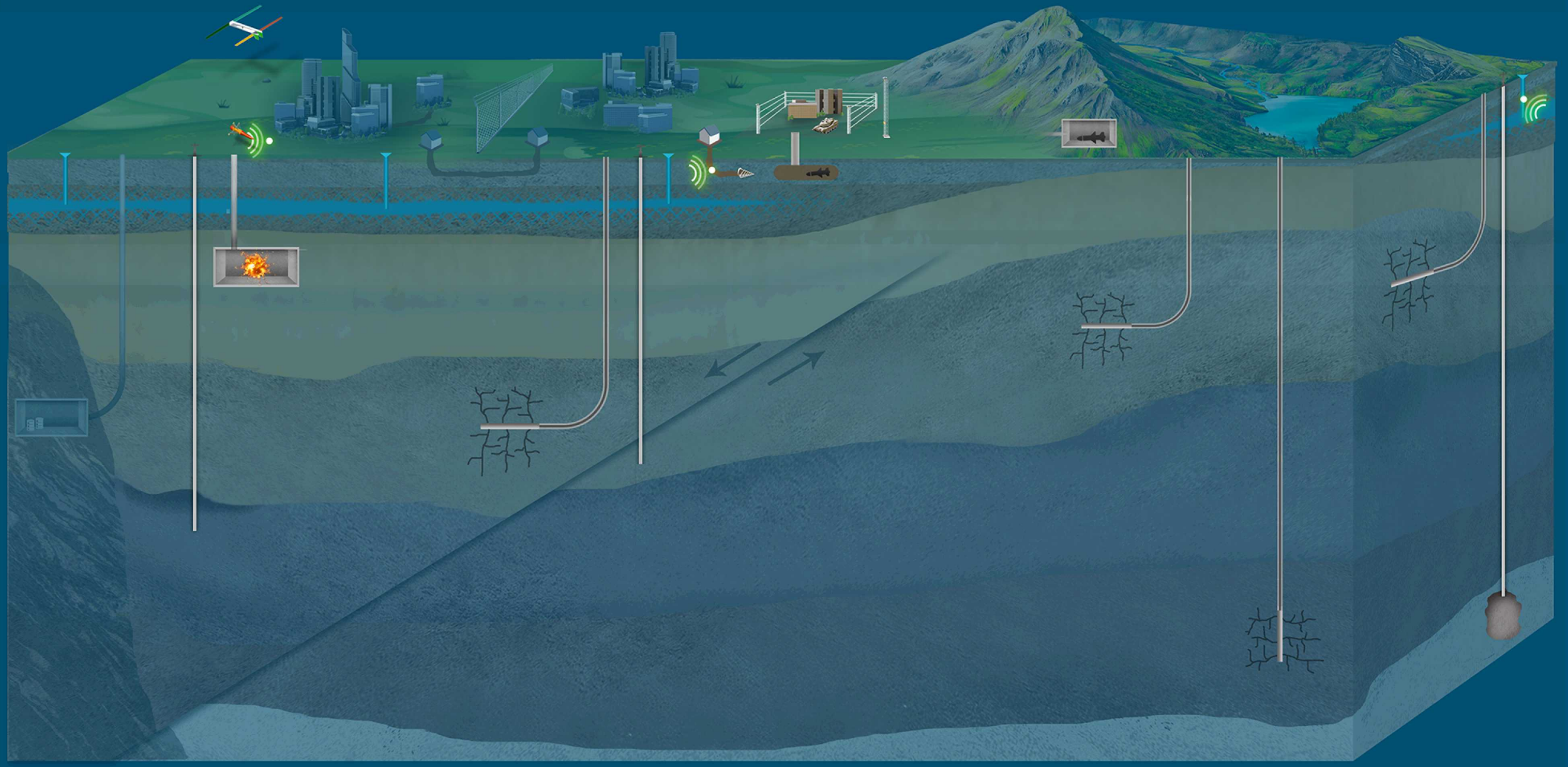


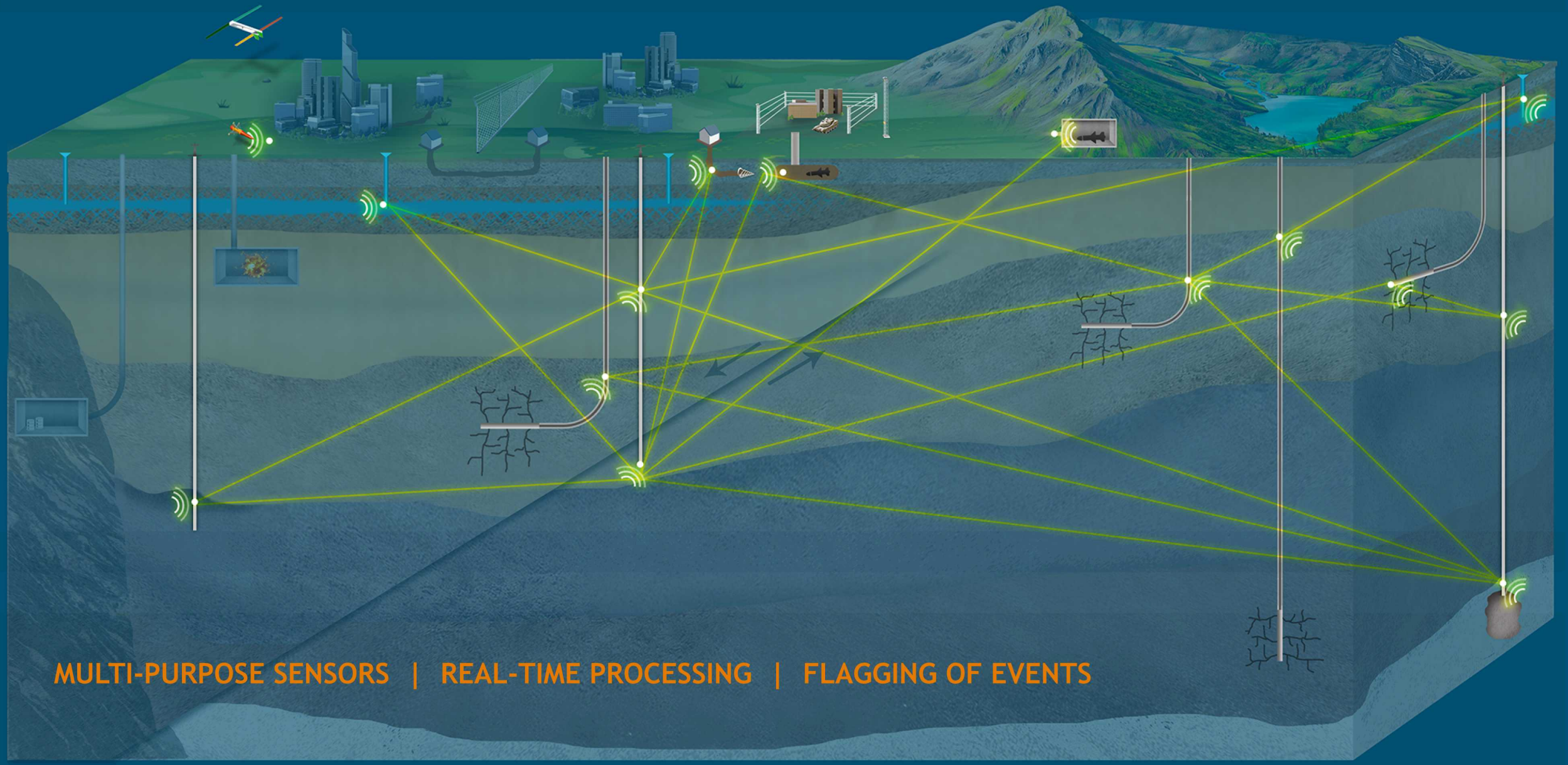




SENSING THE SUBSURFACE IS CRITICAL



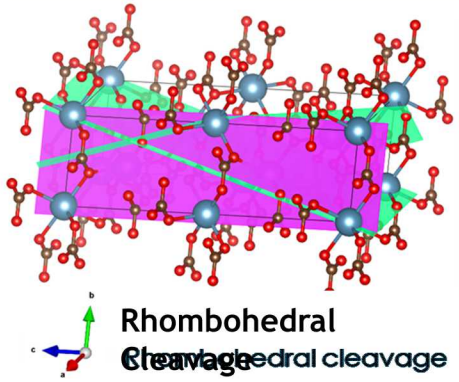


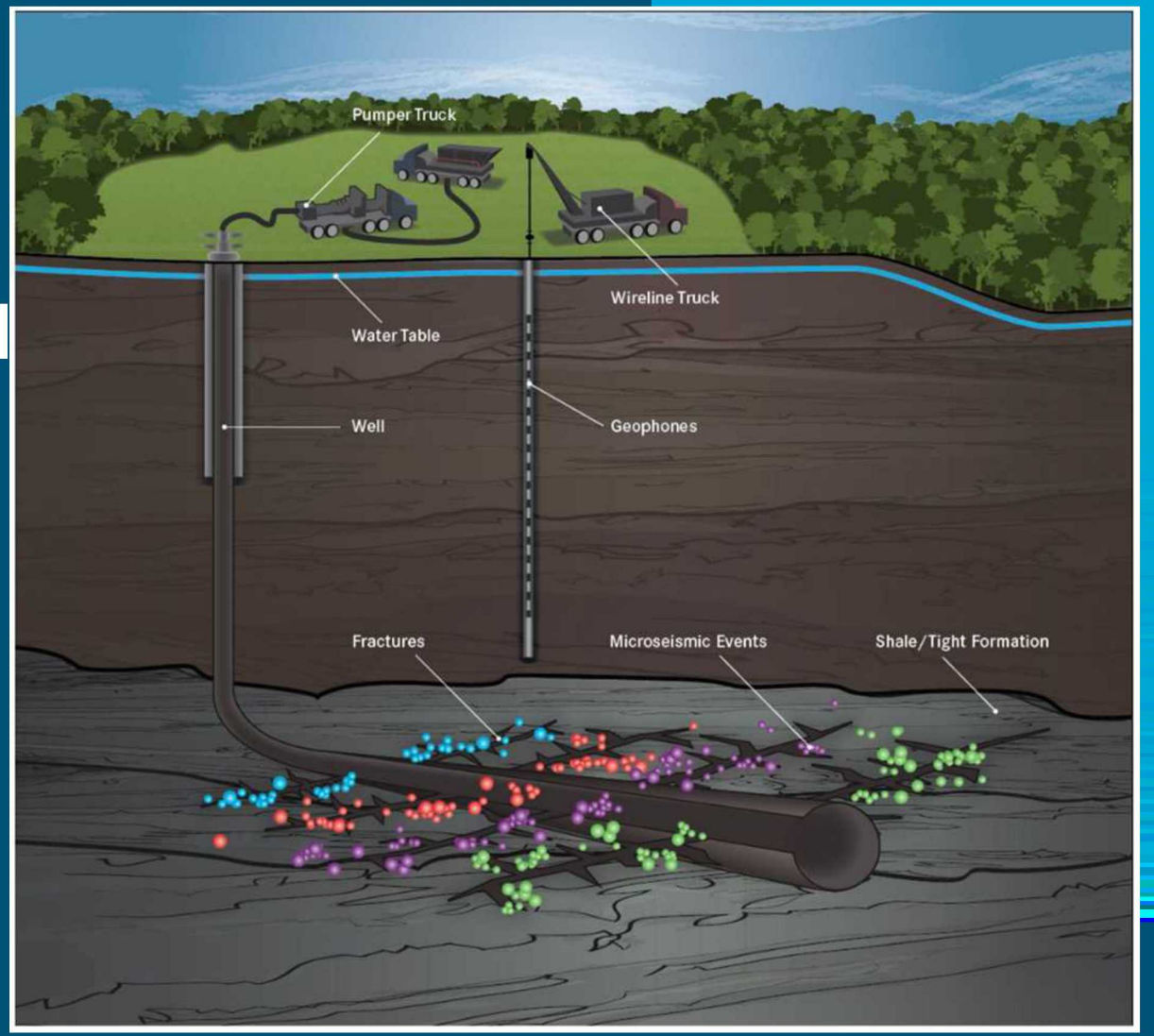


MULTI-PURPOSE SENSORS | REAL-TIME PROCESSING | FLAGGING OF EVENTS

Unconventional Shale

Angle = 134 degrees





ONGOING WELLBORE INTEGRITY PROJECTS

LDRD Geoscience; DOE (Strategic Petroleum Reserve); DOE (FE) Aliso Canyon and California Council of Science and Technologies (CCST), Pipeline and Hazardous Material Safety Administration (PHMSA)

Wellbore leak analysis/diagnostic

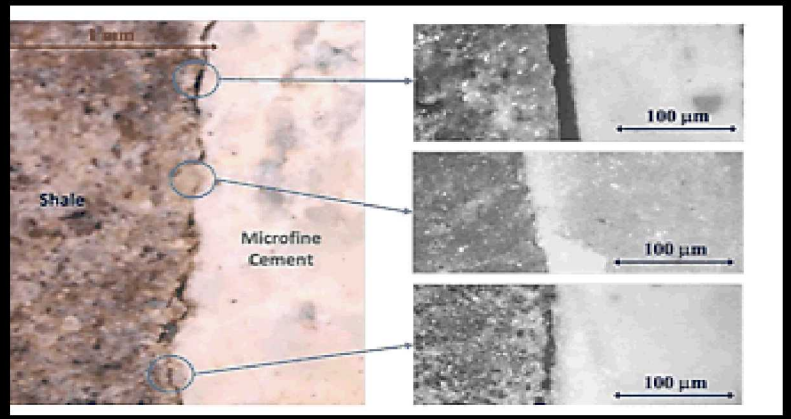
Flow Modeling

Geomechanical Modeling

Field Bleed-off tests

Lab-scale experiments

Remediations & cement repair (HPHT)



- Coupled chemo-mechanics modeling
- Fit for purpose sealants

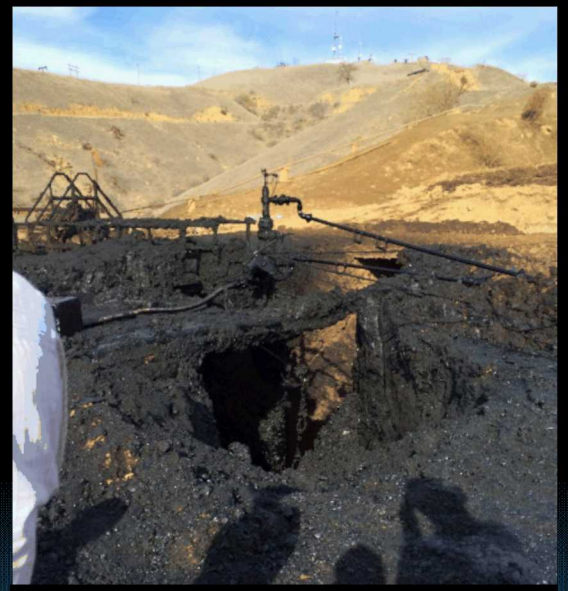
Risk assessment

Combine geology, geomechanics, well logs, pressure measurement etc. to:

- predict failure
- direct monitoring and remediation priority

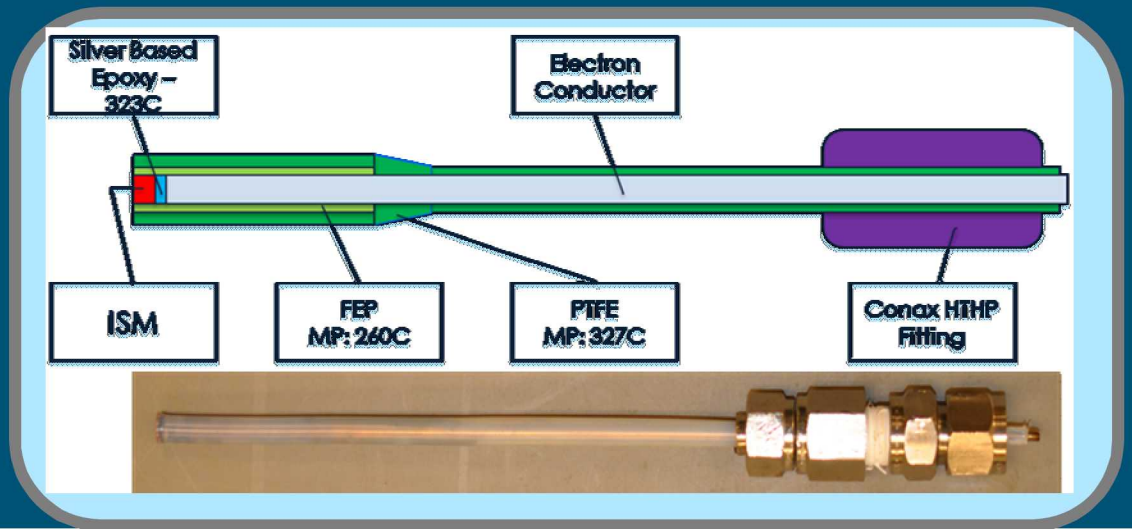
Storage industry & regulators support

Quad-lab team member to review and consult during/ following the Aliso Canyon leak

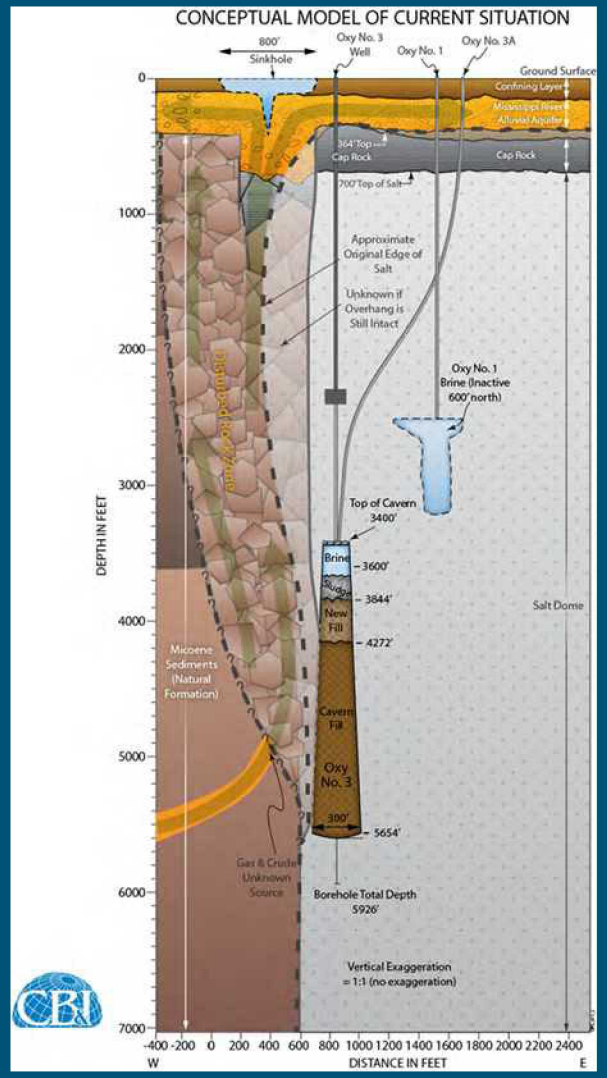


Aliso Canyon leak

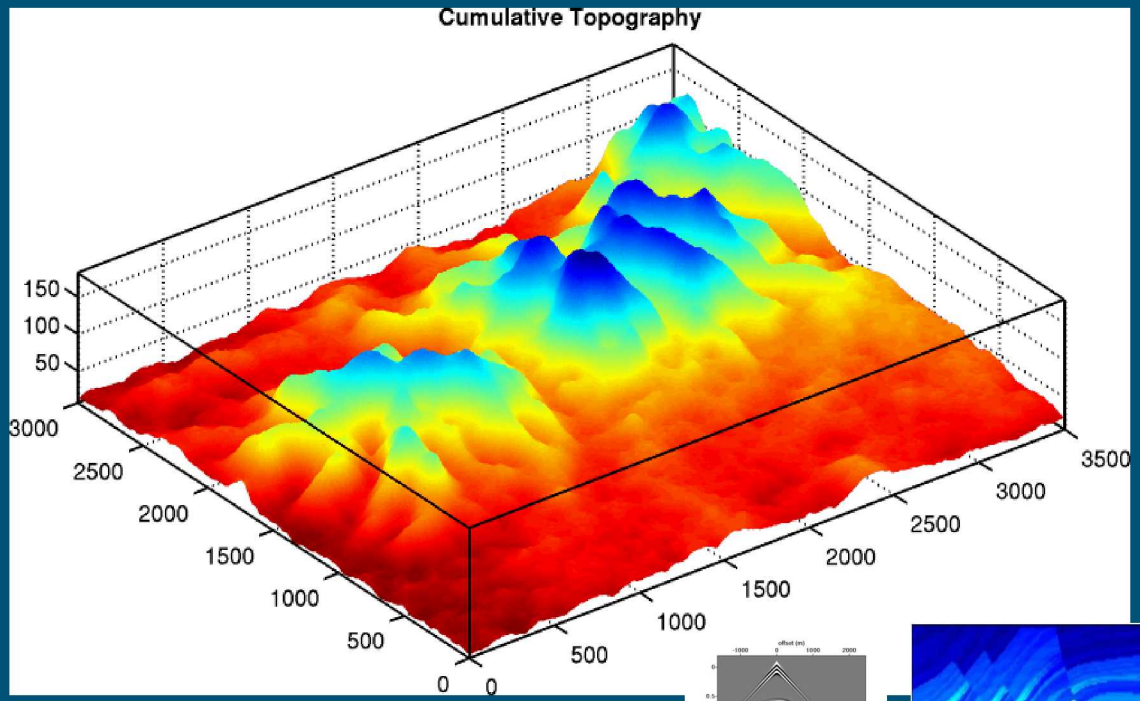
Drilling Technologies

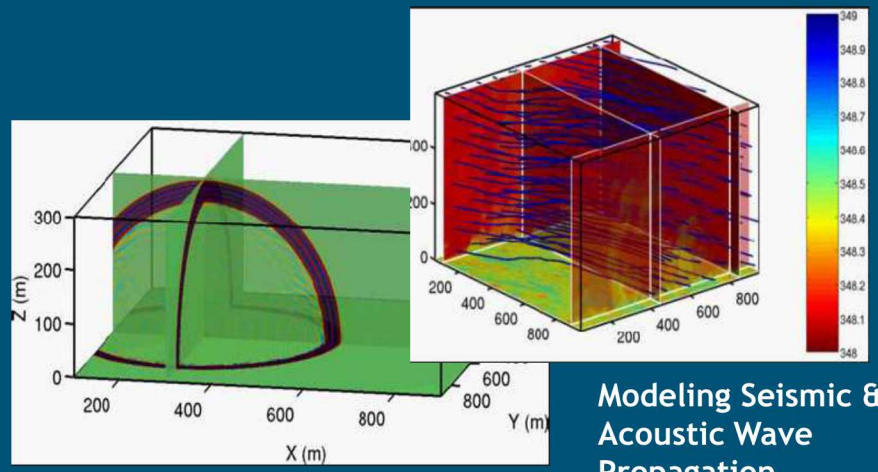


Geophysics Monitoring

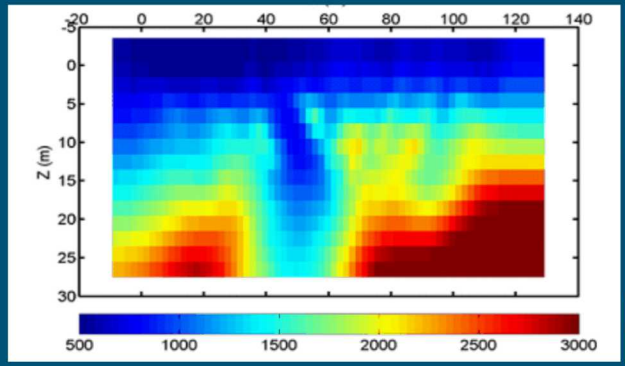


Characterization of Underground Facilities and Shallow Tunnels





Modeling Seismic & Acoustic Wave Propagation



Repository Characterization