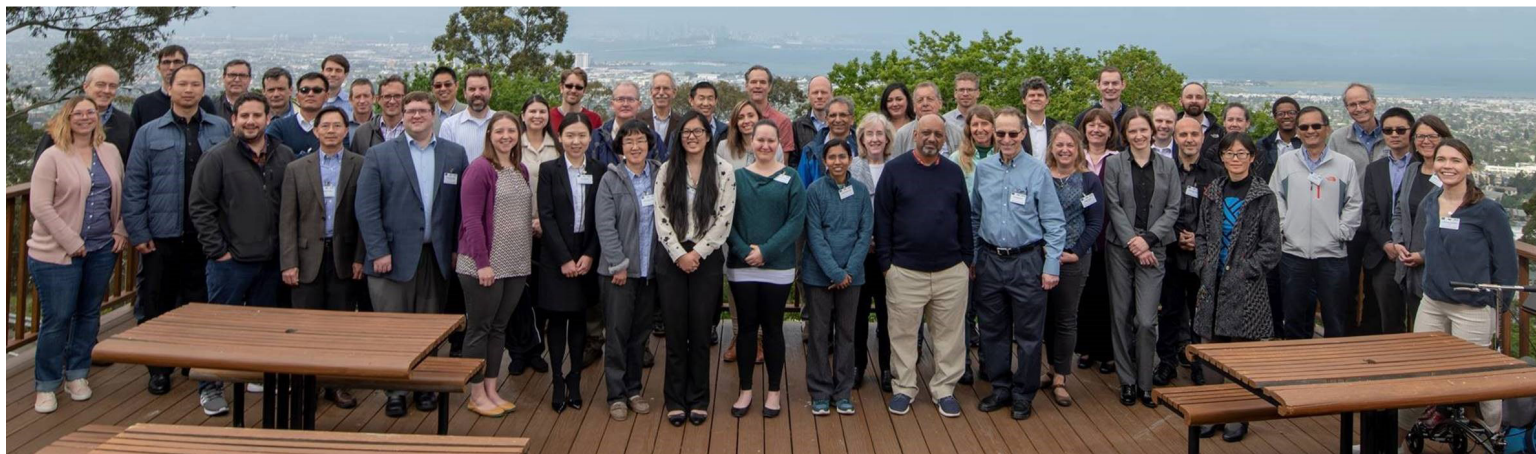


NATIONAL RISK ASSESSMENT PARTNERSHIP (NRAP)



THE NEED FOR QUANTITATIVE RISK ASSESSMENT FOR CARBON UTILIZATION

Carbon capture and storage (CCS) is recognized as a key technology to manage anthropogenic greenhouse gas emissions and enable the environmentally sustainable use of our nation's abundant energy resources. A key element of CCS is geologic carbon storage (GCS). This process involves the injection of carbon dioxide (CO₂) into deep geologic formations to permanently avoid emitting it into the Earth's atmosphere. Substantial scientific knowledge and practical experience gained through decades of research and field demonstration support the perspective that large volumes of captured CO₂ can be safely and permanently stored in deep geologic formations. However, uncertainty in long-term risks related to loss of CO₂ from containment, potential groundwater impacts from leakage and induced seismicity remain a hurdle to broad acceptance of GCS. Quantitatively assessing those risks and understanding how they can be managed is key to informing stakeholders' decisions and building confidence in GCS deployment.

R&D179, April 2024



THE NATIONAL RISK ASSESSMENT PARTNERSHIP

In 2010 the U.S. DOE Carbon Storage Program established the National Risk Assessment Partnership (NRAP) – a research collaboration among five national laboratories: Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Lawrence Berkeley National Laboratory, Pacific Northwest National Laboratory, and the National Energy Technology Laboratory (NETL). Led by NETL, the NRAP team applies its broad technical capabilities to the mission-focused challenge of developing defensible, science-based methodologies and computational platforms for quantifying GCS risks amidst system uncertainty to better inform decision-making.



BUILDING A FOUNDATION FOR GEOLOGIC STORAGE RISK ASSESSMENT

In its first phase of research (2010–2016), NRAP focused on developing the critical science base, foundational methodologies, and groundbreaking predictive tools for rapid estimation of subsurface risks and uncertainty quantification. This work resulted in generation of the first long-term quantitative risk profiles for a full CO₂ storage system, and development and release of a set of 10 computational risk assessment tools — recognized in 2017 by R&D Magazine as one of the year's top 100 most impactful innovations.

In its second phase of research (2017–2022), the NRAP project built on its earlier accomplishments to explore how risks associated with GCS projects can be effectively managed and how uncertainty in risk forecasts can be reduced through strategic monitoring. New, open-source versions of NRAP computational tools were developed and released. In addition to risk quantification, these tools incorporated fit-for-purpose functionality to support stakeholder decisions related to aspects of site characterization, monitoring design, and site closure. Complementary technical reports described recommended practices for quantitative assessment and management of potential leakage and induced seismicity risks at GCS sites. These tools and recommended practices were tested and demonstrated through numerous case studies, and insights from their application were transferred to GCS stakeholders through various workshops and technical presentations.

SUPPORTING STAKEHOLDER NEEDS TO ACCELERATE GEOLOGIC STORAGE DEPLOYMENT: NRAP'S PHASE III

Now entering a third phase of research, NRAP is focused on applied research that will directly support the DOE's Office of Fossil Energy and Carbon Management's goal of ensuring CCS readiness for commercial deployment. NRAP is applying its methods and integrated assessment framework to directly address deployment-critical stakeholder questions related to long-term risk and liability, promote the incorporation of quantitative risk assessment into GCS site development best practices, develop adaptive monitoring design tools for efficient and effective risk management, and address other project life-cycle questions. Finally, the NRAP team will adapt site-scale risk quantification tools and methods to assess risks associated with rapid deployment of multiple commercial-scale GCS operations within a geological basin.

For more information on NRAP, see:

<https://edx.netl.doe.gov/nrap/>



NETL is a U.S. Department of Energy (DOE) national laboratory dedicated to advancing the nation's energy future by creating innovative solutions that strengthen the security, affordability and reliability of energy systems and natural resources. With laboratories and computational capabilities at research facilities in Albany, Oregon; Morgantown, West Virginia; and Pittsburgh, Pennsylvania, NETL addresses energy challenges through implementing DOE programs across the nation and advancing energy technologies related to fossil fuels. By fostering collaborations and conducting world-class research, NETL strives to strengthen national energy security through energy technology development.

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