

Proposed Nuclear Waste Repository, Yucca Mountain, Nevada

Over the past 25-plus years, Yucca Mountain, Nevada has been investigated in detail as a potential site for a high-level nuclear waste repository by the Yucca Mountain Project (YMP). The stability of the underground openings is a major concern in the plan and design of the repository. In order to do appropriate modeling of the *in situ* rock under present and probable future conditions, the study of the mechanical properties of the tuffs is of major importance.

Since 1987, NER has been an active participant in the site characterization investigations for the YMP. The repository is planned within four subunits of the Topopah Spring Member of the Paintbrush Tuff within Yucca Mountain. In general, the Topopah Spring tuff is a silicic, devitrified ash-flow and ash-fall tuff that was deposited approximately 12.8 million years ago. The four subunits are all densely-welded tuffs and defined based on the average volume of lithophysal cavities. Scientists at NER and Sandia National Laboratories have performed a wide range of rock properties measurements on tuff specimens of the Topopah Spring Member recovered from outcrop boulders at Busted Butte, boreholes in Yucca Mountain, and the exploratory study facility (ESF). The comprehensive suite of measurements includes:

bulk properties,

thermal expansion at temperatures to 250°C and pressures to 30 MPa,

elastic properties: static and dynamic elastic moduli,

compressional strength in constant strain rate experiments,

tensile strength in Brazil tests,

creep and static fatigue at 125 and 250°C and an effective pressure of 0.5 MPa,

seismic attenuation measurements at frequencies from 10^{-2} to 10^5 Hz.

Each specimen was well characterized prior to testing. For all specimens tested in compression, compressional and shear wave velocities were measured parallel and normal to the core axis, and a CT scan was performed parallel to the core axis, saturated and unsaturated bulk densities and grain densities were measured. Over the course of the study, tests on over

five hundred specimens were conducted. Most of these data have been published in the open literature, with the remainder available in project publications from Sandia National Laboratories.