

# Performance Assessment

## WHAT IS PERFORMANCE ASSESSMENT?

Performance assessment is a tool that can be used for understanding how well an underground repository retains high-level radioactive wastes. Many factors affect how well a repository will work to retain waste, and to prevent harm to people. These factors, often called “features, events, and processes,” include: climate, waterflow, rock chemistry, design and construction of the repository, strength of the waste containers and how well they resist corrosion, the nature of the waste, and natural events such as earthquakes and volcanoes. Performance assessment is a systematic method for studying the effects of these factors. It is a powerful tool for organizing and analyzing large amounts of information about how a repository works. If the U.S. Department of Energy (DOE) seeks a license to build a repository at Yucca Mountain, Nevada, performance assessment is one of many tools the U.S. Nuclear Regulatory Commission (NRC) would use to judge the safety of the proposed repository.

## WHAT IS ASSESSED?

A performance assessment thoroughly examines what can happen at a repository, how likely it is to happen, and what can result. A performance assessment identifies the key features, events, and processes that are likely to either improve, or degrade, the repository’s capacity to retain waste. Scientists calculate the consequences of these factors, and their chance of happening, to estimate the effects, if any, on human health.

## WHY USE PERFORMANCE ASSESSMENT?

The repository proposed for Yucca Mountain has many natural features and manmade systems that interact and change with time. We need a reasonable understanding of these systems and their complex interactions to assess the safety of a potential repository over thousands of years. Performance assessment methods are commonly used to study the risks from chemical plants, nuclear reactors, transportation systems, and other complex systems. Scientists all over the world use and accept the performance assessment technique.

## HOW IS PERFORMANCE ASSESSMENT CONDUCTED?

A diverse team of expert scientists and engineers completes a performance assessment by:

- Collecting data
- Developing conceptual models
- Developing and testing computer codes
- Analyzing results

The team of experts repeats the steps many times, each time with updated information, to help refine and improve the models. The experts compile information from the DOE site characterization studies, the scientific literature, and technical publications. The assessment team uses this information to decide which features, events, and processes must be studied. Understanding gained from data collection is the basis for developing conceptual models (ideas of how the engineered and natural systems work). The scientists and engineers translate the conceptual models into mathematical equations. The team of experts uses computer codes to solve the equations. An overall model of the repository system is built by combining the computer codes that represent each part of the system. The scientists and engineers study the model results to learn which factors have the greatest influence on repository safety.

## WHAT WOULD NRC REQUIRE?

The NRC must, by law, develop regulations for licensing geologic repositories. These regulations must enforce environmental standards established by the U.S. Environmental Protection Agency (EPA). The NRC has proposed technical requirements that, if met by the DOE, would ensure the proposed repository would be constructed and operated safely. Preparation of a performance assessment is but one of many NRC requirements the DOE would have to meet to show that a proposed repository at Yucca Mountain is safe.

If the DOE applies for a license to construct a repository, the NRC would require that the DOE’s actions comply with the NRC-approved plans. The DOE would need to keep complete records, plan for emergencies, and limit access to the repository. The NRC would require that the DOE provide complete descriptions of the site, schedules for waste acceptance and disposal, as well as detailed plans for site security, and radioactive material control. The NRC also would require the DOE to develop a *performance confirmation and monitoring program* that would extend scientific investigations to verify the safety information that supports the license application. *Preclosure safety requirements* specify that the DOE must address all safety aspects of operation of the facility before permanent closure. Proposed *postclosure safety requirements* include preparation of a complete performance assessment that demonstrates the repository complies with the EPA standards.



## FOR ADDITIONAL INFORMATION

Contact the NRC Office of Public Affairs by telephone at 301-415-8200, by email at OPA@NRC.GOV, on the Internet at <http://www.nrc.gov>, or by U.S. Mail at U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001. A copy of the “Citizen’s Guide to U.S. Nuclear Regulatory Commission Information,” NUREG/BR-0010, can be ordered by writing the Government Printing Office, P.O. Box 37082, Washington, D.C. 20013-7082, or calling 202-512-2249.

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