NUCLEAR WASTE DISPOSAL AND ROCK MECHANICS

There is a lot of talk these days about the Nuclear Treaty with the United States of America. Whereas the broad issue has several dimensions, one aspect that interests the rock mechanics community is the disposal of nuclear waste.

Advocates of Nuclear Power in United States and elsewhere often cite the example of France, not only because it gets about 80 percent of its electricity from nuclear power plants, but also because it re-processes most of its spent nuclear fuel to extract plutonium for reuse as a fuel. Yet, France has a considerable volume of long-living, highly radioactive waste that is slated for disposal in a deep geologic repository.

The main way by which the nuclear waste disposal in a deep geologic repository is likely to affect people far into the future is via contamination of water used for drinking, farming and other purposes that could lead to the ingestion of radionuclides. The threat is from very long living radionuclides with half-lives in the thousands to millions of years.

No repository program has ever claimed that perfect isolation of the waste from the human environment is possible. The goal therefore is to limit the peak radiation dose to levels considered socially acceptable today as expressed in the present day radiation protection standards. Typically, the peak radiation dose is expected to occur hundreds of thousands of years into the future.

Different countries have different guidelines. For example, whereas the French guidelines for research require that the peak dose be limited to 25 millirem per year, the U.S. Environmental Protection Agency Standard for Yucca Mountain limits dose to 15 millirem per year for the first 10,000 years, which is far earlier than the expected peak dose time of the French.

Since, in India, we are relatively new to this area of activity, we must take advantage of the research carried out by others. We must also make our regulatory laws as stringent as possible.

A geologic isolation system basically consists of

i) A deep underground excavation dug into a suitable geological setting.
ii) Waste packages, which consist of the materials in which the radioactive waste is encapsulated and packaged.
iii) Other engineering barriers around the waste packages to retard the movement of radionuclides once they leak from the packages.
iv) The materials used to backfill and seal the excavated zone once the waste has been emplaced in it and

v) The surrounding geologic system that retards the movement of radionuclides once they have been released from the waste packages and other barriers in the "near field".

An assessment of the performance of a geologic isolation system therefore consists of understanding the properties of each of these components and most importantly how they would function together over long periods of time to meet the goal of limiting radiation doses hundreds of thousands of years into the future. Research into the characterization of a site and its associated isolation system must ensure that the necessary data are gathered about the site, that experiments are done on the waste packages and other materials, such as seals, both in laboratories and in-situ, and that a suitable model for estimating performance that is validated by real world data and experience is created.

We have enough expertise in Rock Mechanics in the country, both at the individual and the institutional level to be able to do so. This is true of Governmental Research Organisations, Private Enterprises and the Teaching Institutes. The need of the hour is to organize them into a team, give them adequate facilities and a free hand; and rest assured, they will deliver.

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