Savannah River Site
Citizens Advisory Board

Recommendation 324

L-Basin Cob Webs: Potential Impact of Deep Geologic Storage

Background

In 2011, a mysterious material, referred to as "cobwebs" was found enveloping the tops of spent nuclear fuel assemblies in approximately 7 percent of the L-Basin. The material was discovered during a routine surveillance. Following an analysis by the SRS National Laboratory the mysterious material was declared harmless. Analysis indicated that the cobweb-like mass was composed of a colony containing some 3,000 different bacteria and other microbes.

The Department of Energy (DOE) has indicated in a 2013 Strategy for managing spent nuclear fuel and disposing of defense nuclear waste that the government intends to continue pursuing the concept of deep geologic repository. While the cobwebs in L-Basin were monitored for growth patterns and changes during the test period in the laboratory the issue of what patterns and growth behaviors might transpire during long term disposition in a deep geologic repository must be comprehensively studied and tested.

Deep geologic repositories are what earth scientists refer to as "open systems" of energy and matter. Such environments are in a constant state of flux due to the interactions of the variables contained in them. They are therefore not subject to prediction or control. Predictions on the security of stored spent nuclear fuel and defense waste in these environments are based on assumptions, which cannot be demonstrated.

The presence of any mysterious organic substances within the spent nuclear fuel and defense nuclear waste further raises the risk of unpredictability in deep geologic repositories. The behavior patterns of poorly understood organic substances within these nuclear materials, stored in an unpredictable open systems environment, is beyond the realm of scientific capabilities to describe, understand, predict, and control.

Further, the presence of organic substances in compatible relationships with nuclear materials is not unfamiliar to science and DOE. Colonies similar to those found in L-Basin have also been found existing in the spent fuel from Three Mile Island, shipped to the Idaho National Laboratory following the near meltdown of that nuclear plant. Colonies have also been found co-existing with defense nuclear waste at SRS. These colonies have been assigned the name *kineococcus radiotolerans* due to their resistance to radiation.

Discussion

Given the unpredicted existence of organic materials in several nuclear waste and spent fuel environments and the variable conditions that will occur in deep geologic repositories over time, comprehensive analyses are required prior to storage actions. The risks of behavior pattern development which can be detrimental to long-term storage must be well understood, described, and planned for.

Additionally, since such behavior patterns cannot be controlled according to the dictates of the goals of science, the ability to monitor and alert staff personnel assigned to the management and operation of a repository is critical. Research should therefore focus on development of detection systems and their integration with operations and management.

Every possible aspect of the repository environment should be optimized in a long-term disposition plan. While it is not possible to know all potential variables of the aspects it is possible to transform materials stored there into forms which allow the most effective and efficient management during both storage and emergency retrieval conditions. The material should therefore be subjected to advanced technological processes which reduce volume, radioactivity level, and nuclide half-life. Such technological processes should also be integrated with the operational and management systems.

Recommendations:

The SRS Citizens Advisory Board at SRS recommends that:

1. DOE budget and plan an extensive and comprehensive research and development program focused on comprehensive analyses of organic material behavior patterns during geologic storage with nuclear waste materials.
2. DOE budget and plan for constructing such detection systems and their integration with operations and management systems.
3. DOE assign this mission to the SR National Laboratory.
4. DOE provide full funding for the mission in order that it is completed before the opening of any government deep geologic repositories.
5. SRNL apply to outside sources for additional funding to assure the completion of this mission before the opening of any federal facilities where spent nuclear fuel is stored.