

Faults found at Nevada nuclear waste site

Federal geologists have recently discovered several previously unknown faults slicing through Yucca Mountain in Nevada, the prospective site of the first high-level nuclear waste repository in the United States.

The implications of these findings remain unclear. Yet project opponents say the presence of such faults will hamper plans for storing the nation's most dangerous refuse within Yucca Mountain.

Since 1987, the Department of Energy has been studying this bald ridge 150 kilometers northwest of Las Vegas to determine whether it will make a suitable burial ground for spent radioactive fuel currently accumulating in overcrowded facilities at nuclear power plants around the country. If Yucca Mountain passes the assessment, DOE will then apply to the Nuclear Regulatory Commission for a license to build and operate a repository designed to hold 70,000 tons of waste.

At the earliest, Yucca Mountain would open in 2010. Federal regulations require that the repository keep waste from reaching the environment for 10,000 years.

Geologists have long known that at least one fault cuts through this region, but only in the last 2 years has the U.S. Geological Survey started an extremely fine-scale mapping program.

Last year, Richard W. Spengler with the USGS in Denver and his colleagues reported that the principal fault running through the proposed repository area actually has several parallel strands extending across a width of 215 meters. This feature, called the Ghost Dance fault zone, runs north-south, as do most of the faults around Yucca Mountain.

After working on the Ghost Dance fault, Spengler's group discovered a different zone of parallel faults that trend northwest-southeast through the planned waste site. They described the feature last month in a USGS report titled "The Sundance Fault: A Newly Recognized Shear Zone at Yucca Mountain, Nevada."

In early April, the Nuclear Regulatory Commission received a memo from its Advisory Committee on Nuclear Waste describing the faults. According to the memo, the presence of the Sundance fault could — under certain conditions — lead DOE to limit the size of the repository.

In its preliminary designs for Yucca Mountain, the Energy Department has indicated it will avoid placing waste directly within the Ghost Dance fault zone, which is believed to reach the depth of the repository, 300 m below the surface. If the Sundance fault zone also extends to this depth, DOE will have to decide whether to work around these faults as well.

At present, geologists do not know whether the Sundance and Ghost Dance

faults have generated earthquakes within the last several million years. But even if these structures are not active, they may still threaten the storage facility. Because fractured rocks fill these faults, they could provide a path for groundwater to reach the repository, potentially speeding up the rate at which radionuclides leak into the environment. Faults could have the opposite effect, however, if they contain natural mineral cement that inhibits water flow.

"The basic question that remains unanswered is whether or not any of the faults are barriers to the transport of fluids and gases or whether they are conduits," says Spengler.

Energy Department crews will begin boring an 8-km-long exploratory tunnel into Yucca Mountain this August at the level of the planned repository. The tunnel, which will take 2 years to drill, will intersect the Ghost Dance and Sundance faults. Findings from this excavation and further work at the surface should answer



Nevada's Yucca Mountain.

questions about the significance of these faults, says Mark C. Tynan, a DOE geologist in Las Vegas.

Officials of the state of Nevada, which has opposed the Yucca Mountain project, say the fault discoveries will probably reduce the capacity of the repository. Robert Loux, the executive director of the Nevada Agency for Nuclear Projects, says that DOE would have to reduce the repository's volume by as much as 25 percent to avoid the Sundance and Ghost Dance faults.

Tynan calls such estimates ridiculous. "We don't anticipate that they are going to have a major impact at this time, but testing will continue to determine it," he says.

— R. Monastersky

Beta-carotene may lower vitamin E stores

Beta-carotene supplements, reputed to stave off cancer and other diseases, may lower the body's supply of another presumed cancer fighter — vitamin E — scientists say.

Vitamin E and beta-carotene caught the attention of physicians because of their disease-preventing potential (SN: 9/18/93, p.183). Both substances can act as antioxidants, preventing the cell damage caused by carcinogens. Beta-carotene can also be converted in the body to vitamin A, which prevents night blindness.

Researchers had previously thought that the two substances did not interfere with each other in the body. "That had been the dogma for some time," says Thomas O. Frommel of Loyola University Medical Center in Maywood, Ill. But findings from new studies by Frommel and others suggest a different story.

For 3 months, Frommel and his colleagues gave 81 men and women who had been successfully treated for colon cancer or colon polyps daily doses of either 30 milligrams of beta-carotene or a placebo. They compared this group to 19 healthy volunteers who received no supplements.

Over the study period, concentrations of vitamin E in the colon tissue of the polyp-surgery patients who received beta-carotene decreased 52.6 percent, Frommel reports. Vitamin E in their blood remained stable; however, blood tests do not always indicate accurately the amount of vitamins available to body tissues.

Vitamin E concentrations in the colon tissue of recovered cancer patients who took beta-carotene didn't change significantly over the course of the experiment.

But vitamin E concentrations in their blood did drop considerably, Frommel notes. Vitamin E stores in the tissue and blood of volunteers who received no beta-carotene remained unchanged. The researchers discussed some of these findings April 26 in Anaheim, Calif., at a Federation of American Societies for Experimental Biology conference.

David S. Alberts of the University of Arizona Health Sciences Center in Tucson and his colleagues gave either 30 mg of beta-carotene or 30 mg of beta-carotene plus 400 international units of vitamin E to 25 smokers and 25 nonsmokers for 9 months. After 6 months, those who took only beta-carotene showed a 25 percent drop in vitamin E concentrations in their blood. The scientists obtained similar results in earlier studies.

Blood samples from participants who received both supplements showed increased vitamin E. "The vitamin E supplement overcame the problem completely," asserts Alberts. The researchers are still analyzing the volunteers' tissue samples.

Not all researchers agree that beta-carotene diminishes vitamin E supplies. "In most of the large-scale clinical trials involving beta-carotene supplements there has not been a significant effect on plasma vitamin E," argues Robert S. Parker of Cornell University.

Studies may produce conflicting results because body weight, sex, age, and lipid concentrations in the blood of volunteers may all affect how beta-carotene and vitamin E interact, suggests Elaine B. Feldman of the Medical College of Georgia in Augusta.

— T. Adler