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**Yucca Mountain: Natural Zeolite to Prevent Nuclear Leakage.**

## C:\Documents and Settings\Oluja\Desktop\web 2010\wenb studije\yucca-mountain-natural-zeolite-to-prevent-nuclear-leakage-_a-14-2387_files\11_w.gif[Future Energies](http://www.scitizen.com/future-energies/) by [Chris Rhodes](http://www.scitizen.com/authors/Chris-Rhodes-a-602_s_5e62beb9c27348efac89878c7c0a150b.html), 4 Dec, 2008

**The long term security of the Yucca Mountain storage facility for nuclear waste will depend on a complex interplay between human engineering and natural geological factors. The site is intended as a repository for 75,000 tonnes of high level radioactive waste, for which the surrounding geology is rich in rocks containing natural zeolites, such as clinoptilolite and mordenite. The presence of these materials is considered a major plus in choosing the location of any such storage facility.**

The long term security of the Yucca Mountain storage facility for nuclear waste will depend on a complex interplay between human engineering and natural geological factors, so concludes a report by scientists at Indiana University Bloomington (IUB) and Los Alamos National laboratory. The site is intended as a repository for 75,000 tonnes of high level radioactive waste, for which the surrounding geology is rich in zeolitic tuffs - rocks containing natural zeolites, such as clinoptilolite and mordenite. Indeed, the presence of these materials is considered a major plus in choosing the location of any such storage facility.

Zeolites are aluminosilicates, containing a honeycomb framework which carries an overall negative electrical charge. Much as nature is said to abhor a vacuum, she has a similar antipathy for loose unbalanced electrical charges, and consequently the negative charge on the framework is balanced by an according number of positively charged cations, rendering an overall electrical neutrality. The cations that are naturally present, e.g. Ca2+, Mg2+, K+, Na+, may be readily exchanged by radioactive cations such as Sr2+, Ba2+ and Cs+, which are products of nuclear fission, thus absorbing them from the immediate environment. Thus, any leakage or adventitious spillage can be intercepted, by the intrinsic property of cation-exchange by these natural zeolites.... a natural fail-safe barrier should the engineering not prove completely true.

Zeolites absorb appreciable quantities of water, in some cases up to half their own volume of it, and this may act to absorb and buffer the heat generated during the radioactive decay of cations such as Sr2+, Ba2+ and Cs+ when they are absorbed within its structure. [Zeolites are also known as microporous solids, since the honeycomb structure contains pores of molecular dimensions and so can act as molecular sponges].

Some fission products are formed as anions, with a negative charge, and are not readily absorbed by zeolites since there is no anion-exchange mechanism possible, in counterpart with the case for cations. Very large ions are also excluded by clinoptilolite and mordenite, and so are not absorbed either, thus the process is not perfect. Nonetheless, zeolites are used for both preemptive protection of the environment from radioactive ions, e.g. to filter the waters from nuclear power plants and reactors, and in direct emergency decontamination strategies, e.g. after the Chernobyl disaster, where 500,000 tonnes of zeolites were employed to absorb fall-out from the radioactive cloud that emanated from the smouldering unit 4 reactor, on its way across western Europe. Zeolites were fed to cattle and even baked into biscuits for children to remove some of the radioactive ions from their bodies, thus mitigating radiation injury, both directly and via the food chain, e.g. drinking milk from contaminated cattle.

Over 2,000 samples taken from 17 cores drilled across Yucca mountain, at depths ranging from 20 metres to 1,800 metres below the surface. X-ray diffraction measurements showed that there are zeolites present extensively, and moreover at depths reckoned as optimum for the storage of nuclear waste, i.e. 300 metres below the surface of the mountain and 150 metres above the water table. The idea is to construct a containment space above the zeolitic safety-region.

David Bish, the report's principal author and Professor of Applied Clay Mineralogy at IUB stressed the need to understand more about how water flows through the repository horizon and how the incorporation of large amounts of high level radioactive material might modify the geology, mineralogy and hydrology (i.e. the structure and properties, chemical and mechanical), of the zone of rock in which it will be included. The intention is to construct a 3-D image of Yucca Mountain, of sufficient detail that it could be used in licensing considerations.

If all goes well, nuclear waste could be sent to Yucca Mountain by 2010. The site is 100 miles from Las Vegas and near to the DOE's Nevada test site where numerous A-bomb tests have been performed since its inauguration in 1948.