If not Yucca Mountain, then what?

One of the biggest obstacles facing the nuclear industry is what to do with spent nuclear fuel. Because it is highly radioactive and will remain so for many thousands of years, spent nuclear fuel is inherently dangerous to human health and to future generations. Because it contains materials used in making nuclear weapons, spent fuel also poses proliferation risks.
Most countries' preferred option for isolating spent fuel from humans and the environment is to bury it underground in a deep geological repository. In the United States, which has a repository schedule decades ahead of other countries, Yucca Mountain is being offered by the nuclear establishment as the sole solution for the disposal of spent fuel. Proponents want it to be the country's first underground storage facility for spent fuel from the 100-plus commercial nuclear power plants in the United States. But Yucca is not a sound solution to the nuclear waste problem. This fact sheet, presented in point-counterpoint format, tells why and offers an alternative to dealing with nuclear waste.

Argument: *"Yucca Mountain is a scientifically sound site in which to dispose of spent nuclear fuel. That's why it was chosen."*
Counter: Yucca Mountain is not a scientifically sound solution for the disposal of spent nuclear fuel. The decision to site Yucca Mountain as a waste repository was based on politics, not science.
It is common sense, and sound science, to site and build a nuclear waste repository to isolate radioactive waste as completely as possible from the human environment for the hazardous lifetime of the waste. But even some of the U.S. government's own assessments indicate that Yucca Mountain is not capable of isolating radioactive waste from the environment for this long. [1] The geology of Yucca Mountain, volcanic tuff, is not expected to provide an adequate barrier in the long term. Also, serious questions have been raised about the integrity of the canisters that would hold the spent fuel. U.S. Department of Energy (DOE) assessments assume that the engineered barriers, notably the metal canisters, will provide adequate containment. Yet these canisters are made of an alloy that has been in existence for only about two decades and studied very briefly. Like all metals in an oxidizing environment, the canisters could corrode under certain conditions of moisture and temperature. DOE's models of canister performance are based on relatively scant data and contain large uncertainties.
Yucca Mountain is in the desert, but there is evidence that water has welled up into the region in the geologic past according to a study published in 1999 by an independent technical group. [2] This issue is an important one because water is expected to be the main pathway by which radioactive materials from repository spent fuel would reach the human environment. The issue of how long ago the water may have risen to the repository level is still a matter of scientific controversy. Water is also a principal means by which the containment of the wastes may become compromised. Yet the DOE's plans assume the underground area will remain relatively dry for hundreds of centuries.
History illustrates that Yucca was chosen based on politics, not science. In 1982, Congress passed the Nuclear Waste Policy Act, a law which designated deep geologic disposal as the preferred technical solution for nuclear waste disposal, essentially curtailing or terminating serious research and development on other methods like deep borehole or sub-seabed disposal. The law stipulated that explicit site selection and environmental criteria be adopted, and that a final site be selected from among numerous sites examined on the basis of detailed characterization studies. However, the Dept. of Energy's problem-ridden site selection process, flaws in law and in federal regulations, and vigorous citizen opposition led to a more politically convenient solution. Congress amended the Nuclear Waste Policy Act in 1987, overriding many of the original site selection and characterization provisions. Congress voted to

eliminate other contenders and concentrate on Yucca Mountain as the sole site to be examined as a candidate for the first high-level waste repository, even before scientific studies were completed. Thus the final selection of Yucca Mountain came about as a result of a process in which politics overwhelmed science. [3]

Argument: *"The spent nuclear fuel stored in pools at reactor sites is too vulnerable to proliferation and terrorism to leave in place, so it must be moved to Yucca Mountain. It is safer to store spent fuel at one site rather than at dozens. Besides, Congress promised in 1982 that a repository would operate by 1998 so, legally, the wastes can't stay on site."*

Counter: Moving waste to Yucca Mountain will not eliminate risks associated with nuclear power plants, it would only create another waste dump. In the event of a transportation accident, moving waste to Yucca could create more than one more nuclear site. Furthermore, shipping waste to Yucca Mountain will not decrease the terrorist threat associated with spent fuel; it may even increase the risk by putting nuclear waste on the country's rails and roads.

Storage of spent fuel on-site for several decades is feasible and can generally be done relatively safely, if industry and regulatory authorities pay due attention to the safety issues involved. For example, the design and licensing requirements of on-site storage casks should be strictly implemented and enforced to ensure that they can safely handle wastes for several decades. Both European studies and the U.S. Nuclear Regulatory Commission state that "dry spent fuel storage is safe and environmentally acceptable for a period of 100 years." [4] In some instances, such as in severe earthquake zones or on riverine islands, storage near the site may be safer than on site. However, moving the waste would give rise to its own issues and is generally difficult to accomplish.

It should be noted that on-site storage is not a sound strategy for the long term. It risks a host of problems, including the possibility of reprocessing, social instability, leaks and accidents, or destruction of waste storage containers by natural disasters or terrorism. There is also a high potential for neglect in economically difficult times. The problem of neglect may become more serious after the utility has shut down the reactor since the plant would not be generating any more income. Operating power plants would continue to create and store on-site spent nuclear fuel even if Yucca Mountain were opening. These problems must be addressed regardless of where the waste is ultimately put.

Moving spent fuel to an interim spot (for instance a monitored retrievable storage facility proposed for the Skull Valley Goshute land in Utah) before any long-term management solution is decided upon carries a host of new risks arising from: transportation of the wastes; the possible need to transport wastes again; temptations to reprocess the spent fuel, causing more pollution and proliferation risks; safety problems associated with loading, unloading and reloading canisters; and hasty decisions regarding canisters that should be far more carefully made. These risks are both unnecessary and are qualitatively more serious than storage of spent fuel at reactor sites, which have, after all, been licensed for operation of reactors that generally carry far greater safety risks than spent fuel storage.

Some of the financial and legal arguments of the utilities do have merit. The DOE did sign contracts with them to begin taking charge of the waste in 1998, although it was done as part of deadlines in the 1982 Nuclear Waste Policy Act that were set without reference to environmental protection or sound nuclear waste management. Moreover, the problem of spent fuel management after a reactor is shut down is a serious one. These issues can be addressed within the framework of on-site storage. The federal government should pay for additional on-site storage necessitated by delays in the repository program but only for wastes covered by existing license periods for presently operating reactors. The funds should come from the Nuclear Waste Fund and not from general taxpayer revenues. Spent fuel from existing nuclear power plants beyond their presently licensed lifetimes or from new nuclear power plants should

be excluded by law from federal assumption of waste management liabilities. Future nuclear power plant owners and licensees should bear the full liability for the waste they produce.

Argument: *"We should wait until a technology is invented that will "neutralize" nuclear waste, in other words turn it into a benign substance."*
Counter: Difficult as it may be to accept, it is highly unlikely that there will be any future technological "silver bullet" that addresses all of the important technical, environmental and proliferation issues simultaneously, even if cost is left out of the picture.
There are no ideal options for managing highly radioactive waste. Technologies that result in (or could easily be modified to result in) the separation of weapons usable materials, such as reprocessing and accelerator transmutation of waste, should be rejected. Transmutation creates intolerable proliferation risks and leaves behind significant amounts of long-lived wastes which would still require long-term management. Reprocessing spent nuclear fuel would reverse a quarter century of bipartisan non-proliferation policy over five administrations. Even if the intent of these technologies is to manage nuclear wastes, their development involves proliferation risks that are too great.

Argument: *"If not Yucca Mountain, then what?"*
Counter: The Institute for Energy and Environmental Research (IEER), a scientific institution with expertise in nuclear waste management and related issues, published an alternative plan for the short- and long-term management of highly radioactive waste in 1999. It is summarized here and details are available in Science for Democratic Action Volume 7, Number 3.
In the short term, irradiated reactor fuel should be stored as safely as possible on site or as close to the point of generation as possible for an interim period (several decades) that would be long enough to allow a long-term management plan to be implemented. In light of the attacks of September 11, IEER has recommended on-site or close-to-site subsurface dry storage of spent fuel, in the type of structures built for the storage of the vitrified high-level wastes at the DOE's Savannah River Site in South Carolina. This would reduce the risk of large-scale catastrophe in case of a terrorist attack. The federal government should use monies from the Nuclear Waste Fund to pay for additional on-site storage necessitated by delays in the repository program.
For the long-term, more basic research on various geologic settings is needed before sites for permanent disposal of radioactive waste can be scientifically screened. IEER recommends three broad approaches for waste storage research: geologic disposal on land, sub-seabed disposal, and upper mantle disposal. The main aim would be to yield sufficient data and analysis in one to two decades to enable a comparison between these options. Repository types need to be considered in tandem with the development of engineered barriers that mimic natural materials and structures that retard the migration of radioactivity for millions of years or more.
Various kinds of repository types and environments should be studied for ten to fifteen years without any attempt to identify, rank, or screen specific locations as potential repository sites. Yucca Mountain should be converted into a research center for scientific investigation of problems central to the concept of geologic repository disposal of waste, subject to approval by the Western Shoshone people, who do not recognize as valid the U.S. government's ownership claim to the land on which Yucca Mountain sits, and the state of Nevada.
The institutional framework for the long-term research is at least as important as the technical issues. IEER has recommended that a public corporation be established to handle certain aspects associated with the long-term management of highly radioactive waste. The details of this proposal are available in Science for Democratic Action Volume 7, Number 3.

It is premature at this time to select actual repository sites or even to engage in a site selection process. Finding an appropriate repository site is a very difficult and complex process that must balance a wide range of considerations, including sound science, which has not yet been completed.

This fact sheet was written by Lisa Ledwidge of the Institute for Energy and Environmental Research for the Alliance for Nuclear Accountability *and was based largely on IEER materials, especially* *High-Level Dollars, Low-Level Sense* *and* Science for Democratic Action Volume 7, Number 3.

Notes:

1. See Science for Democratic Action Volume 7, Number 3 (Takoma Park, Maryland : Institute for Energy and Environmental Research), May 1999. ? Return
2. Yuri Dublyansky, *Fluid Inclusion Studies at Yucca Mountain* (Takoma Park, Maryland : Institute for Energy and Environmental Research), 1998. ? Return
3. For more information see Arjun Makhijani and Scott Saleska, *High-Level Dollars, Low-Level Sense* (New York : Apex Press), 1992. ? Return
4. 55 Fed. Reg. 38482 (September 18, 1990). ? Return

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