Nuclear Waste: What Can We Do?

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Every time you flip on a light, turn on your computer, or turn up the thermostat, electricity is being used. Most of the time we take for granted this cheap source of energy. Many times we don't even know where our electricity comes from. In the United States, a growing percentage of our electricity is generated by the radioactive fission of uranium.

While nuclear energy doesn't release the sulfur- and nitrogen-oxides and other pollutants associated with fossil fuels, it has problems of its own. When the fuel needs to be replaced, it is still very radioactive. This waste will continue to be radioactive for a very long time, the EPA has said 10,000 years, while Greenpeace estimates over 100,000 years. The United States Department of Energy (DOE), the caretaker of the nation's nuclear waste, has proposed many varied solutions in the past. Other agencies that have proposed solutions include the World Nuclear Association and the Commitee on Radioactive Waste Management. Some of these solutions would appear to be quite radical, such as using rockets to propel the waste out of our atmosphere and into the sun, or inserting the waste into the areas where two tectonic plates meet, a so-called 'subduction' zone. Other ideas that are more along the traditional lines of thinking include pumping liquefied waste into underground reservoirs, surface storage, and underground storage. The National Academy of Sciences issued a report in 1990 stating that there is *"a worldwide scientific consensus that deep geological disposal, the approach being followed by the United States, is the best option for disposing of highly radioactive waste."* According to the Office of Civilian Radioactive Waste Management, waste is currently stored at the reactor, initially in a shielded, water-filled pool, then adjacent to the reactor in metal-reinforced concrete casks.

Figure 1: On-Site Water Storage

Figure 2: Dry Cask Nuclear Waste Storage

The US Nuclear Regulatory Commission provides a good history of the country's legislation concerning atomic energy and the regulation of nuclear waste. In 1982 congress established the Nuclear Waste Policy Act, which made the DOE responsible for finding a site, building, and operating an underground disposal facility. In 1983, the DOE selected nine sites in six states for study and consideration for a storage location. When the study was completed in

1985, President Reagan approved three sites for further review. These three sites were Hanford, WA; Deaf Smith County, TX; and Yucca Mountain, NV. In 1987 congress amended the Nuclear Waste Policy Act, directing the DOE to only consider the Yucca Mountain site, which was also the site of a nuclear test range. Obviously, the citizens and lawmakers of Nevada are protesting this decision, and many lawsuits have been filed already. The Denver Post, the largest daily newspaper to oppose the Yucca Mt. Project to date, argues that scientific studies at Yucca Mt. should be completed before Congress approves the site, saying *"the solution should be driven by rational science, not political hype."*

One of the largest objections to this centralized waste storage facility is the danger associated with transporting radioactive wastes across the country. The waste would have to travel through 38 states, not only by truck, but also on rail, and possibly by barge. Many citizens outside of Nevada fear disaster from this transportation through their own states. The State of Nevada's Nuclear Waste Project Office estimates, *"The amount of waste shipped to a repository in the first full year of operations alone will exceed the total amount shipped in the United States for the past 30 years."* Not only does the concern about transportation encompass accidents, fires, and punctures, but also the threat of terrorist attacks on a radioactive convoy. Another concern is the low-level radioactivity that is legally permitted to be emitted from the transports. *"Federal regulations allow shipping casks to emit 10 millirems/hour at 2 meters from the cask surface, equivalent to about one chest x-ray per hour of exposure."*

The waste that needs to be transported and stored away is at the very end of a long chain of steps in the nuclear fuel cycle. After a long enrichment process, the fuel is condensed into ceramic fuel pellets, which are stacked together to create a fuel rod. Many fuel rods are combined to create a fuel assembly. See Figure 3.

After the fuel rod is removed from the reactor core, it is still very radioactive and highly dangerous. According to the World Nuclear Association, *"Spent fuel still contains approximately 96% of its original uranium"* Through a process known as *reprocessing*, much of this fuel can be recovered and reused, thus

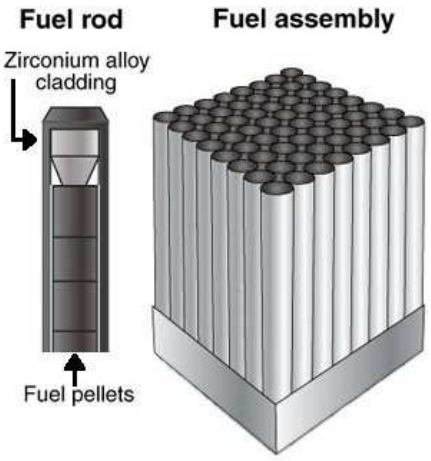

Figure 3: Fuel Rod and Assembly

reducing the total ammount of waste that needs to be disposed of. As a side effect of the fuel reprocessing, the unusable portion of the fuel is removed in liquid form. This part of the waste is known as *transuranic waste*, and is encased in a chemically stable glass, a process known as *vitrification.* This form of the waste is easier to transport and store.

In its quest to safely dispose of our nation's nuclear waste, the DOE has looked solely at the Yucca Mountain repository. Some people think that this is the perfect solution, but others feel that more scientific research is necessary. Regardless of the storage method or waste type, the final resting place for the waste is sure to be a very contested issue both now and in the future.