

Jose P. Perez

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Introduction to Technical Communication – Ethics in Technology

### Nuclear Waste Management Dilemma

#### **Abstract**

This paper describes the main methods considered for high level waste management: short-term storage, long-term storage, and reprocessing, and their political dilemmas. The Yucca Mountain Repository, the chosen long-term storage site, has many critics who claim that it and the transportation of nuclear waste are unreliable. Reprocessing also has many critics who say that it is very expensive and unsafe proliferation-wise. However, the changing nuclear industry and economy bring about new perspectives for these dilemmas. Nevertheless, the political dilemmas must be resolved for the nuclear industry to survive.

#### **Introduction**

Radioactive waste is a waste type containing radioactive chemical elements that does not have a practical purpose and is harmful for human beings. Nuclear waste can be generally classified as either low level radioactive waste or high level radioactive waste. Low level nuclear waste usually includes material used to handle the highly radioactive parts of nuclear reactors and waste from medical procedures involving radioactive treatments such as x-rays. The disposal of low level radioactive waste is relatively easy. The level of radioactivity and the half life of the radioactive isotopes in low level waste are reasonably small. Storing the waste for a period of ten to fifty years will allow most of the radioactive isotopes in low level nuclear waste to decay, and then the waste can be disposed of as normal garbage. On the other hand, the disposal of high level radioactive waste has many obstacles. High level radioactive waste is generally material from the core of the nuclear reactor or nuclear weapon. This waste includes uranium, plutonium, and other highly radioactive elements made during fission. Most of the radioactive isotopes in high level waste emit large amounts of radiation and have extremely long half-lives, creating long time before the waste will settle to safe levels of radioactivity.

High level radioactive waste has accumulated through many years of nuclear operations and now poor nuclear waste management threatens the continuation of the

nuclear industry as a stable source of energy. This is particularly true in the United States where most nuclear power plants are approaching the end of the operational time period permitted in their licenses and the radioactive waste accumulated is exceeding the maximum storage capacity for each nuclear plant. Also, the end of the cold war left us with radioactive waste from decommissioned nuclear missiles. The disposal of high level radioactive waste from nuclear power plants and nuclear missiles has always been a political dilemma. Recently, many debates have been discussing this nuclear waste management problem. This paper will describe the main methods considered for high level waste management: short-term storage, long-term storage, and reprocessing, and their political dilemmas.

### **Short-term Storage**

Short-term storage greatly decreases the radioactivity of spent nuclear fuel. Ten-year storage can bring a hundredfold decrease in radioactivity. Radioactive material decays in an exponential fashion, thus a reduction of radioactive emissions, similar to that of the first ten years, would take another hundred years of storage after the first ten. Experts in the nuclear energy field state that, ideally, radioactive waste should be stored for at least ten years before moving from the nuclear plant site. The reduction in radioactivity makes handling and shipment of the waste possible. After short-term storage the waste is sent for long-term storage or for reprocessing. Short-term storage does not pose such political dilemmas as long-term storage or reprocessing do; however it is still a fundamental phase in nuclear waste disposal.

### **Long-term Storage - The Once Through Method**

Although there are methods of significantly reducing the amount of high level radioactive waste, such as reprocessing, some or all high level radioactive waste should end in long-term storage. The U.S. current nuclear waste disposal technique is known as the Once-through Method, in which spent fuel is sent unaltered for long-term disposal. "Long-term" refers to a period of thousands of years; hence security of the radioactive waste must be guaranteed over immense time periods. The waste cannot be allowed to escape to the outside environment by any predictable accident, malicious action, or geological activity. These include accidental uncovering, removal by potential thieves, contact of the waste with the water supply, and exposure from seismic movements or

other ecological events. Moreover, this security must be maintained over an unimaginable large period of time, since some high level radioactive material will take over 20,000 years to decay. Furthermore, plutonium and other actinide elements, produced as byproducts of uranium fission are, not only highly radioactive, but also highly poisonous. Thus, long-term storage of highly radioactive and poisonous material is such a political predicament.

### **Yucca Mountain Repository**

As part of the Nuclear Waste Policy Act of 1982, the U.S. Department of Energy was made responsible of finding a suitable site for long-term storage of 77,000 metric tons of highly radioactive waste. In 1987, the Yucca Mountain was chosen to be the most suitable place for long-term storage. However, since then, many critics have opposed the Yucca Mountain Repository.

Many critics argue that the Yucca Mountain not a suitable site for nuclear waste disposal. As Brian Hansen (2001) states in his article titled “Nuclear Waste,” critics argue that once the waste is entombed, radioactive material will leak into the aquifer below containing drinking water used throughout the desert Southwest. Hansen also talks about critics that claim the Yucca Mountain is a highly seismic and volcanic region. However, Hansen also claims that scientific studies at the Yucca Mountain guarantee the safety of even the nearest living people. They certify that neither seismic activity will disturb the nuclear waste nor will a volcanic eruption occur within millions of years.

Furthermore, for the waste repository to be in the Yucca Mountain, transportation by trains of spent fuel is needed. As Jennifer Weeks (2006) remarks in her article titled “Nuclear Energy,” critics argue that transportation by trains of highly radioactive nuclear waste is dangerous. They say it is possible for a catastrophic accident such as Chernobyl’s disaster to occur. However, Weeks also notes that professionals have proved the safety of train transportation of spent fuel.

Also, President Bush has recommended building more nuclear energy plants in response to high oil and natural gas costs, continuing concern about global warming, and the U.S. energy deficiency. Additionally, old nuclear power plants are trying to renew their expiring licenses. Consequently, as Jennifer Weeks (2006) state, the nuclear waste

stockpile will increase rapidly, requiring more storage sites such as the Yucca Mountain Repository.

### **Reprocessing**

Nuclear reprocessing separates any usable elements from fission products and other materials in spent nuclear reactor fuels. Usually the goal is to recycle the reprocessed uranium, to use it again in nuclear reactors, but some reprocessing is done to obtain plutonium for weapons. Furthermore, reprocessing does not eliminate the need for long-term storage.

One of the most harmful drawbacks of reprocessing spent nuclear fuel is its high cost. Steve Fetter and Frank von Hippel (2005) correctly state that reprocessing spent fuel is far more expensive than storing spent fuel and buying new uranium.

Fetter and von Hippel (2005), as most critics of reprocessing, argue that reprocessing spent fuel contributes to nuclear weapons proliferation since reprocessing extracts uranium and plutonium from nuclear waste. Plutonium creates many proliferation concerns as it could be used for nuclear weapons. Fetter and von Hippel also argue that potential thieves can steal plutonium and create nuclear warheads. However, new reprocessing techniques such as the UREX+ technique make it impossible for potential thieves to steal plutonium since it leaves plutonium too radioactive to handle.

Conversely, as Brian Hansen (2001) states, reprocessing would aid the long-term storage of highly radioactive nuclear waste. Although it is very expensive, reprocessing would lower nuclear waste by a great factor, delaying the search for a second nuclear repository.

### **A New Perspective**

Janet Wood (2006) brings a new perspective with her article titled “Should USA Reprocess?” She argues that reprocessing has become the solution to the U.S. waste disposal problem. She also claims that economics have shifted, driven by higher uranium prices and by a deeper understanding of long-term storage. Additionally, she argues that reprocessing has experienced a “demonstrated, long-term operational effectiveness” (p. 41). Furthermore, the costs of reprocessing can be closely related to those of the Yucca Mountain Repository overall, since so much delaying has ensued. Janet Wood’s perspective is very important for the development of a solution. The economy will

certainly play a major role in the solution of the waste management problem. A shift in the economy will change every perspective in the waste management problem.

### **Conclusion**

Short-term storage, long-term storage, and reprocessing are the main methods considered for high level waste disposal. The latter two provide many political dilemmas that must be resolved. The Yucca Mountain Repository, the chosen long-term storage site, has many critics who claim that it and the transportation of nuclear waste are unreliable. Reprocessing also has many critics who say that it is very expensive and a risky proliferation-wise. However, the currently changing nuclear industry, including increasing uranium prices and better understanding of long-term storage, gives many new perspectives to the waste management problem. Nevertheless, the political dilemma must be resolved for the nuclear industry to survive.

### References

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