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Interim Storage, Environmental Justice, and Generational Equity

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ABSTRACT

With the termination of the Yucca Mountain project, which was proposed to be our nation's first repository for the disposal of military and civilian spent nuclear fuel and high-level radioactive waste, the future of nuclear waste management and disposal in this country became increasingly uncertain. Interim storage has been advocated by many as a temporary solution while a permanent solution is studied for potentially several more decades to come. Should we embrace interim storage as a safe and effective method of storage while this country takes a fresh new look at the nuclear waste problem, or are we simply passing this burden on to future generations? One could argue that we have an ethical obligation to provide a safe and secure environment for future generations; thus, we need a long-term (permanent) solution to the nuclear waste problem now rather than delaying any further. Interim storage potentially exposes nearby residents to radioactive contaminants from accidents and leaks or acts of sabotage or terrorism, and it threatens the national security of this country because these nuclear materials will be more vulnerable to theft, especially during transportation to storage sites for the surplus waste. Additionally, interim storage presumes that future societies will maintain adequate knowledge and will be sufficiently stable and capable of maintaining the safety of the facility and protecting human health and the environment, and there is always the risk that the waste will be forgotten or simply ignored over time. More importantly, it is not fair to leave this problem for future generations to resolve. On the other hand, one could argue that interim storage would provide a safe, flexible, and cost-effective short-term solution while scientists and authorities evaluate alternatives (e.g., disposal options) and policy issues (e.g., reprocessing of spent fuel). Interim storage is a necessary part of the fuel cycle and is meant to complement, not replace, other approaches. It keeps all options open and provides maximum flexibility to adapt to future policies, perceptions, attitudes, regulations, and technology developments. Moreover, the technology is safe and cost effective. The cost of storing spent fuel for 40 years is less than a tenth of a cent per kilowatt-hour of electricity generated, and the Nuclear Regulatory Commission has concluded that dry cask storage of spent fuel would be safe for 100 years[1]. The argument that interim storage is a risk to national security is overblown because the plutonium is bound up in spent fuel assemblies making it difficult to steal and recover the plutonium for use in nuclear weapons. Finally, is it fair to deprive future generations the opportunity to decide the fate of this country's nuclear waste? Both sides of the issue are discussed and debated.

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INTRODUCTION

The United States (U.S.) relies on electricity generated from 104 licensed nuclear reactors at 66 locations for 20% of our nation's electricity[2]. The Nuclear Waste Policy Act of 1982 (Ref. 3) gave the federal government responsibility and a deadline of January 31, 1998, to begin accepting nuclear waste from our nation's commercial reactors. Not only has the federal government missed that deadline, but now, with the termination of the Yucca Mountain project, which was proposed to be our nation's first deep geologic repository for the permanent disposal of commercial nuclear waste, the future of nuclear waste management and disposal in this country has become increasingly uncertain.

In this paper, *interim storage* is defined as one or more facilities located across the U.S., designed for the express purpose of storing nuclear materials produced during nuclear power generation, to be held there temporarily until a permanent solution to the waste problem is identified. Thus, it does not include temporary storage at nuclear power plants, the current disposition of many of these materials as discussed below. As of June 2010, the spent fuel inventory in the U.S. was approximately 63,700 metric ton units (MTU) with 2,000 to 2,400 MTU being added annually[4]. All of our nation's nuclear power plants, with the exception of the Harris Nuclear Power Plant in New Hill, North Carolina, have a dry fuel storage facility for the temporary storage of spent fuel. However, some of those power plants are running out of storage space. The dry storage inventory (through 2009) was 14,600 MTU, and the dry storage inventory is estimated to be 26,200 MTU by 2020 (Ref. 4).

Interim storage has been advocated by many as a temporary solution to the nuclear waste disposal problem while a permanent solution is studied for potentially several more decades to come. Should we embrace interim storage as a safe and effective method of storage while this country takes a fresh new look at the nuclear waste problem, or are we stalling and simply passing this burden on to future generations? This paper does not attempt to provide an answer to the debate, but rather, it is intended to present both sides of the issue as basis for further discussion.

THE CASE FOR INTERIM STORAGE

Scientists and policy-makers have been discussing the merits of interim storage of nuclear waste since the 1970s (Ref. 5). Proponents have argued that it represents a strategic element of an integrated nuclear waste management program, providing a safe, flexible, and cost-effective short-term solution while scientists and authorities evaluate alternatives and policy issues[1,6]. For example, an interim facility would allow for storage and retrievability of the waste while long-term disposal options are evaluated and also provide additional time to investigate the policy and technical issues surrounding reprocessing. However, even with a closed fuel cycle, a permanent disposal solution will still be needed for the waste byproducts from reprocessing.

Interim storage is also cost effective. One estimate places the cost of storing spent fuel for 40 years at less than a tenth of a cent per kilowatt-hour of electricity generated, and the Nuclear Regulatory Commission (NRC) has concluded that dry cask storage of spent fuel would be safe for 100 years[1]. However, most advocates propose a period of 40 to 60 years as adequate to develop a long-term plan and the required technologies to safely manage and dispose of our nation's nuclear waste.

Statistics show that transportation to an interim facility would likely pose little additional risk to human health and the environment. There have been over 3,000 shipments of spent fuel in the U.S., 78% by truck and 22% by rail, over the last four decades for a total of 1.7 million miles traveled, with no injuries, fatalities, or environmental impacts[7]. And finally, the argument that interim storage poses a risk to national security is overblown because the plutonium is bound up in spent fuel assemblies making it difficult to steal and recover the plutonium for use in nuclear weapons. However, there is a risk that these materials could be used in radiological dispersal devices, improvised nuclear devices, or in another manner during acts of radiological terrorism.

OPPOSITION TO INTERIM STORAGE

Opponents have argued that interim storage is less desirable than simply leaving the waste where it is currently stored at reactor sites[8]. Existing sites could be "hardened" to serve as temporary storage facilities until a long-term solution is identified, thereby eliminating

potential transportation risks, reducing overall storage costs, and allowing for more effective handling of security issues. In addition, interim storage does not reassure the public that a permanent disposal solution is within our reach and it may be perceived as a stall tactic, or worse, that the interim storage facility may become the *de facto* storage site for the permanent disposal of nuclear waste.

Strong public opposition to one or more interim facilities could potentially delay waste transfer for an unreasonable period of time, negating its benefits and delaying implementation of a long-term solution. The two greatest sources of public opposition are transportation and "not in my backyard" (NIMBY) issues, the same issues encountered during the siting of a permanent disposal facility. Opponents need only point to the Government Accountability Office recommendation from July 2003 as evidence that the number of nuclear waste shipments should be minimized in order to enhance spent fuel security[8]. Furthermore, the siting of multiple interim facilities, which seems likely given the logistical issues and the distribution of waste across the country, would exacerbate the NIMBY problem and further delay implementation of the interim option. And finally, because interim storage will likely require the same level of forethought and planning as a permanent solution, it could require many years before it is actually implemented so why not just address the permanent solution now?

Interim storage also potentially exposes nearby residents to radioactive contaminants from accidents and leaks or acts of sabotage or terrorism, and it threatens the national security of this country because these nuclear materials will be more vulnerable to theft, especially if the same level of forethought and planning is not on par with that of a permanent storage facility.

In terms of economic costs associated with interim storage, it may be grossly underestimated, and history bears this out. If anyone had said 25 years ago that it would cost upwards of $100 billion just to get the Yucca Mountain License Application submitted to the NRC, we would have said they were crazy, but that's very close to what has been spent to reach that milestone. Allison Macfarlane from the Massachusetts Institute of Technology has reported that the costs associated with onsite storage at reactor sites versus centralized interim storage are roughly similar; however, the costs associated with transportation to an interim facility increases the overall costs of this option by 40% (Ref. 9). Thus, although the utilities may not like it, storage at their sites is the most cost effective option.

ENVIRONMENTAL JUSTICE AND GENERATIONAL EQUITY

One issue that seems to have been ignored in the whole interim storage debate is the issue of environmental justice, especially in terms of generational equity, or fairness. When we think of environmental justice, we frequently think of present populations, those who might reside in the vicinity of the proposed facility or along the transportation route, but let's consider future generations. The Environmental Protection Agency (EPA) defines environmental justice as the "fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies"[10]. Well, future generations are not here to represent themselves in this debate; interim storage will delay implementation of the long-term disposal option and burden those future generations with nuclear waste that we produced in order that we could live the lifestyles to which we have become accustomed. There is a strong argument that we, as a society, have an ethical obligation to provide a safe and secure environment for future generations by taking responsibility for the nuclear waste that we have created, and "taking responsibility" means developing and implementing the long-term solution as quickly as possible rather than placing waste in interim storage that could remain there for three generations or more.

Another important consideration in the interim storage debate is the presumption that future societies will maintain adequate knowledge and will be sufficiently stable and capable of maintaining the safety of the interim facility and protecting human health and the environment. There is always the risk that the waste will be forgotten or simply ignored over time, which is why the Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, only presumes that active institutional control will be maintained for a period of 100 years[11]. Finally, many believe that after nuclear waste is transported to an interim facility, it will remain there for a very long time, if not permanently. WIPP provides ample support for this

belief as the decision to temporarily store long-lived radionuclides there in 1970 resulted in it becoming the permanent disposal site two decades later. If we don't even have a permanent disposal facility today, after beginning our research and development for one nearly 40 years ago, why should one believe that we will have one in a reasonable timeframe going forward?

CONCLUSIONS

The debate on interim storage will surely continue. However, it is important to consider the impact our indecision will have on future generations. Long after we're gone, the nuclear waste that we have produced so that we can live the lifestyles to which we have become accustomed will be left for our children, grandchildren, and great-grandchildren to deal with. Although preliminary studies indicate that interim storage can be effectively accomplished, there is a strong argument that we, as a society, should take responsibility for our own waste generation and not leave it for future generations to handle. Because interim storage will likely require the same level of forethought and planning as a permanent storage facility, it may not be possible to implement it for years to come so why not address a permanent solution now? The *Blue Ribbon Commission on America's Nuclear Future* will make recommendations for future policies and programs, and we can only hope that their recommendations will address disposal options in a reasonable timeframe to relieve future generations of our burden.

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