**A Proposal to Research the Storage Facility  
for Spent Nuclear Fuel at Yucca Mountain**

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**Introduction**

Nuclear power plants produce more than 20 percent of the electricity used in the United States [Murray, 1989]. Unfortunately, nuclear fission, the process used to create this large amount energy, creates significant amounts of high level radioactive waste. More than 30,000 metric tons of nuclear waste have arisen from U.S. commercial reactors as well as high level nuclear weapons waste, such as uranium and plutonium [Roush, 1995]. Because of the build-up of this waste, some power plants will be forced to shut down. To avoid losing an important source of energy, a safe and economical place to keep this waste is necessary. This document proposes a literature review of whether Yucca Mountain is a suitable site for a nuclear waste repository. The proposed review will discuss the economical and environmental aspects of a national storage facility. This proposal includes my methods for gathering information, a schedule for completing the review, and my qualifications.

**Statement of Problem**

On January 1, 1998, the Department of Energy (DOE) must accept spent nuclear fuel from commercial plants for permanent storage [Clark, 1997]. However, the DOE is undecided on where to put this high level radioactive waste. Yucca Mountain, located in Nevada, is a proposed site.

There are many questions regarding the safety of the Yucca Mountain waste repository. Researchers at Los Alamos National Laboratory disagree over the long-term safety of the proposed high level nuclear waste site located in Nevada. In 1994, Charles Bowman, a researcher at Los Alamos, developed a theory claiming that years of storing waste in the mountain may actually start a nuclear chain reaction and explode, similar to an atomic bomb [Taubes, 1995]. The stir caused by theory suggests that researchers have not explored all sides of the safety issue concerning potentially hazardous situations at Yucca Mountain.

Bowman's theory that Yucca Mountain could explode is based upon the idea that enough waste will eventually disperse through the rock to create a critical mass. A critical mass is an amount of fissile material, such as plutonium, containing enough mass to start a neutron chain reaction [Murray, 1989]. Bowman argues that if this chain reaction were started underground, the rocks in the ground would help keep the system compressed and speed up the chain reaction [Taubes, 1995]. A chain reaction formed underground could then generate huge amounts of energy in a fraction of a second, resulting in a nuclear blast. A nuclear explosion of this magnitude would emit large amounts of radioactivity into the air and ground water.

Another safety concern is the possibility of a volcanic eruption in Yucca Mountain. The long-term nuclear waste storage facility needs to remain stable for at least 10,000 years to allow the radioactive isotopes to decay to natural levels [Clark, 1997]. There are at least a dozen young volcanoes within 40 kilometers of the proposed Yucca Mountain waste site [Weiss, 1996]. The proximity of Yucca Mountain to these volcanoes makes it possible to have a volcanic eruption pass through the spent fuel waste repository. Such a volcanic eruption could release damaging amounts of radioactivity to the environment.

**Objectives**

I propose to review the available literature about using Yucca Mountain as a possible repository for spent nuclear fuel. In this review I will achieve the following two goals:

(1) explain the criteria for a suitable repository of high-level radioactive waste; and

(2) determine whether Yucca Mountain meets these criteria.

According to the Department of Energy (DOE), a repository for high-level radioactive waste must meet several criteria including safety, location, and economics [Roush, 1995]. Safety includes not only the effect of the repository on people near the site, but also people along the transportation routes to the site. In my research I will consider both groups of people. As far as location, a waste site cannot be in an area with a large population or near a ground water supply. Also, because one of the most significant factors in determining the life span of a possible repository is how long the waste storage canisters will remain in tact, the waste site must be located in a dry climate to eliminate the moisture that can cause the waste canisters to corrode. The economics involved in selecting a site is another criterion. At present, the Department of Energy (DOE) has spent more than 1.7 billion dollars on the Yucca Mountain project [Taubes, 1995]. For that reason, much pressure exists to select Yucca Mountain as a repository site; otherwise, this money would have been wasted. Other costs, though, have to be considered. For instance, how economical is it to transport radioactive waste across several states to a single national site? I will try to account for as many of these other costs as possible.

After explaining the criteria, I will assess how well Yucca Mountain meets those criteria. In this assessment, I will not assign a numerical score for each criterion. Rather, I will discuss qualitatively how well Yucca Mountain meets each criterion. In some situations, disagreement exists among experts as to how well Yucca Mountain meets a criterion. In such cases, I will present both sides. In this assessment, only Yucca Mountain will be considered as a possible site. Although many sites in the United States could meet the DOE's established criteria, I will consider only Yucca Mountain because the DOE is considering only Yucca Mountain [Taube, 1995].

**Plan of Action**

This section presents my plan for obtaining the objectives discussed in the previous section. There has been an increase of interest in the nuclear industry concerning the Yucca Mountain site because of the January 1,1998, deadline for the DOE. Several journal articles and papers discussing the possibility of Yucca Mountain as a spent fuel repository in our near future have surfaced as a consequence of that interest. These articles and books about the dangers of nuclear waste should provide sufficient information for me to complete my review. The following two paragraphs will discuss how I will use these sources in my research.

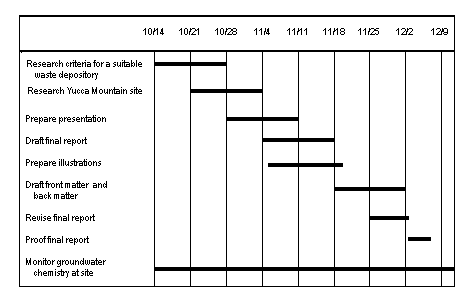
The first goal of my research is to explain the criteria for determining whether a nuclear waste repository is suitable. For example, will the rock structure be able to withstand human invasion in the future [Clark, 1997]? What will happen if the waste containers corrode and do not last as long as predicted? Will the natural setting contain the waste? To achieve this goal, I will rely on "Background on 40 CFR Part 197 Environmental Standards for Yucca Mountain" [Clark, 1997], the DOE Yucca Mountain home page [1997], and the book Understanding Radioactive Waste [Murray, 1989].

A second goal of my literature review is to evaluate Yucca Mountain meets those criteria. I will base my evaluation on the sources mentioned above as well as specific Environmental Protection Agency standards. I also intend to research the validity of possible environmental disasters, such as the explosion theory. To accomplish this goal, I will rely on the paper presented by Clark [1997], and on the book Blowup at Yucca Mountain [Taubes, 1995].

Because engineering students are the primary audience for my proposed research topic and may not be familiar with the history of nuclear waste, I will provide a background on past methods used for waste storage. People in the nuclear field with some knowledge of the waste problem facing the industry may be a secondary audience.

**Management Plan**

This section presents my schedule, costs, and qualifications for completing the proposed research. This research culminates in a formal report, which will be completed by December 5, 1997. To reach this goal, I will follow the schedule presented in Figure 1. Since I already possess literature on the subject of Yucca Mountain as a nuclear waste site, most of my time will be spent sorting through the literature to find key results, and presenting those results to the audience.



**Figure 1.** Schedule for completion of the literature review. The formal presentation will be on October 27, and the formal report will be completed by December 5.

Given that all my sources are available through the University of Wisconsin library system, there is no appreciable cost associated with performing this review, unless one takes into consideration the amount of tuition spent on maintaining the university libraries. The only other minor costs are photocopying articles, creating transparencies for my presentation, printing my report, and binding my report. I estimate these expenses will not exceed $20.

I am a senior in the Engineering Physics Department at the University of Wisconsin at Madison, majoring in nuclear engineering and physics. I have taken several classes related to nuclear waste, economics, and environmental studies. I believe that these courses will aid me in preparing the proposed review. For further information about my qualifications, see the attached resume.

**Conclusion**

More than 30,000 metric tons of nuclear waste have arisen from U.S. commercial reactors as well as high level nuclear weapons waste, such as uranium and plutonium [Roush, 1995]. This document has proposed research to evaluate the possibility of using Yucca Mountain as a possible repository for this spent nuclear fuel. The proposed research will achieve the following goals: (1) explain the criteria necessary to make a suitable high level radioactive waste repository, and (2) determine if Yucca Mountain meets these criteria. The research will include a formal presentation on November 11 and a formal report on December 5.

**References**

Clark, Raymond L., "Background on 40 CFR Part 197 Environmental Radiation Protection Standards for Yucca Mountain," *Proceedings of the 1997 Waste Management Conference*(Washington, D.C.: U.S. Environmental Protection Agency, 1997).

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