2008

Yucca : yikes! the wrong solution, wrong place, wrong time

Justin Carey
California State University, Monterey Bay

Yucca: Yikes!

The Wrong Solution, Wrong Place, Wrong Time

Justin Carey

California State University Monterey Bay

Global Studies

Capstone

Abstract

This paper examines Yucca Mountain as the nation's first planned permanent repository for nuclear waste. In addition to analyzing the efficacy of the site itself, I also examine the possible ramifications that opening this mountain site may have on the nuclear power revival movement and renewable 'green' forms of energy. These issues were explored using the historical, descriptive, comparative and qualitative methods. As a consequence of applying these methodologies I determined: The Yucca site to be geologically unstable; transportation issues associated with nuclear waste are more problematic than first envisioned; the choice of this particular mountain site involves environmental racism of the worst kind; the Yucca repository may lessen the fears associated with nuclear waste in the minds of the public to the point where centralized nuclear power of this sort will once again proliferate; and this proliferation is 'not' the most suitable option for meeting America's future energy needs and; a 'decentralized approach' of adding power through renewable sources of 'green' energy would serve the nation best over the long term; thereby mitigating or even eliminating the need to build a repository at Yucca Mountain.

Table of Contents

Introduction: Is Yucca a Solution or a Major Impediment to a Greener Future?

Yucca Mountain in Nevada is slated by the DOE to become the nation's first permanent repository for highly radioactive nuclear waste. With America's growing energy crisis and the looming threat of global warming, what ramifications would the creation of Yucca have on the fierce debate surrounding a centralized power grid based on a series of small, strategically positioned nuclear power plants around the country versus a decentralized power grid based on alternative, non-polluting power sources. Should Yucca prevail it may result in a behavioral 'paradigm shift' on the part of the U.S. public; thus with their fears of potential nuclear waste contamination assuaged people might be enticed to 'jump start' the licensing and building of many new nuclear power plants all across the country. Over the past few decades the construction of such facilities have been placed in 'mothballs', but that could all change.

Under the guise of national security and to quench our ever increasing need for more energy it might not take too much convincing on the part of governmental and corporate power centers to sway the public decision making process in favor of nuclear power and Yucca is their 'ace in the hole', the catalyst, if you will, to put this entire process into motion. How might such a change of public sentiments in favor of the powerful nuclear industry lobby impact the momentum and monies available for developing renewable forms of 'green energy' e.g. wind, solar hydro power? It is difficult to estimate the impact, but we do know that there are only finite amounts of financial resources the U.S. can devote per unit time to any energy-based endeavor. If much of the money is shifted over to the power elite favoring the development of Yucca, then it is likely that the renewable energy movement will be stunted, perhaps even 'still born' as

we rapidly approach the second decade of the 21st century.

Research Methods: Determining the Best Path to Move Forward

To analyze the public policy dictating the development of Yucca Mountain, I apply primarily four methods. I first use the historical method to explain the questions of 'why' and 'how' regarding the policy making decisions that led to Yucca Mountain being designated as the nation's first repository for nuclear waste. Next, I apply the descriptive method to provide a systematic description of the current situation and the concerns regarding the opening of the mountain. To buttress these concerns I apply the comparative method in relation to other nuclear power-related issues, which have occurred in the recent past e.g. Three Mile Island & Chernobyl. In addition, I will deploy the quantitative method with an analysis of various data from the literature to examine the safety of the site itself, transportation of nuclear waste to the mountain, and the possible environmental impacts. The qualitative method will identify possible alternatives to Yucca Mountain in the event that this site is rejected as the repository for the country's radioactive waste

Theoretical Framework: Will Hype or Facts Win Out in Deciding the Fate of Yucca?

My examination of the controversial Yucca Mountain development utilizes decision making theory and specifically the 'behavioral decision' theoretical constructs, described in literature authored by Rajeev Gowda and Jeffrey Carl Fox, which dealt with issues surrounding how the judgments and decisions people arrive at i.e. that impact on public policy are not necessarily based on sound reasoning. According to the authors, decision theory seeks to 'capture the complexity of human judgments and choices' and how 'systemic errors or biases in judgment' may result in less than optimal public policy

decisions being rendered. This is due to the notion that peoples' decision-making behavior(s) are most heavily influenced by their perception of 'what is real', not necessarily what the facts show and peoples' fears or emotional states can play a large role in determining the outcome (Gowda & Fox, 2002).

Given the complexity of issues surrounding nuclear waste it is quite probable that the policy makers will continue to stall and evaluate an ever increasing body of research (some based on scientific methods, some not); however, failing to make a decision or move forward also carries with it a host of consequences. This paper will forecast the repercussions of the 'universe' of potential decisions that may come from the Yucca Mountain dispute, and discuss how the consequences may impact our society, U.S. energy policy, and the global community for the foreseeable future.

Literature Review: Yucca Mountain, Past, Present & Future

Meaningful and effective authorization for developing a geologically 'failsafe' repository for spent nuclear fuel had its origins in the Nuclear Waste Policy Act (1982). In the years following this legislation, the Department of Energy (DOE) was charged with the duty to search for viable sites for the long term storage of radioactive waste. As a result the DOE initially selected three potential sites for further analysis, but this was later whittled down to just one: Yucca Mountain in Nevada. Zacha (2006) notes that the State of Nevada opposed this 'singled out' site selection from its inception. In the interest of public perception and perceived fairness the DOE has been exploring the potential of a second repository, which would be located east of the Mississippi, but this process has not stopped the momentum from continuing onward with the development of the Yucca site. For example, The Alliance for Nuclear Accountability (2007) is tracking events

carefully and indicates that the DOE is planning on licensing Yucca Mountain for construction by 6/30/08, and there has already been much in the way of 'unofficial' construction underway for many years at the site. Ultimately the DOE is moving forward with the creation of this huge repository, which would allow the initial shipments of nuclear waste from the nation's 104 nuclear reactors to be moved into Yucca by 2017.

The geological attributes of Yucca as a 'safe' storage place for dangerous waste, or the lack thereof have been hotly debated. Public Citizen (2005), a national public interest group, has called attention to several major drawbacks to the safety of the Yucca Mountain site including: (a) the nuclear waste may infiltrate the groundwater since there is a large freshwater aquifer under the mountain; and (b) the site is not geologically stable and in fact is subject to both volcanic activity and earthquakes. Results of the latest DOE study (2007) of the Yucca site directly contradict the aforementioned challenges that the mountain is not a safe place to store waste. The DOE claims that the site is naturally arid with little possibility for any waste to ever seep into the water table. The agency indicates that the likelihood of 'disruptive' events such as earthquakes or volcanism are remote at best, and that the mountain is sufficiently isolated from any population centers to ever present a danger to the public.

Whether or not nuclear power proliferates in the United States after a long period of inactivity may very well hinge on Yucca. Smith and Makhijani (2006) demonstrate that the lack of a repository has become a major stumbling block to the expansion of nuclear power, and should the debate over Yucca be settled in favor of the mountain's development it could lead to the rapid proliferation of more nuclear power plants. Smith, a physics professor at the State University of New York, and Makhijani,

President of the non-profit Institute for Energy and Environmental Research, believe that expanding nuclear power plant development may generate a host of consequences. These include the following: ever increasing amounts of nuclear waste, which assuming a constant rate of growth until 2050, means that a Yucca Mountain sized facility will need to be brought on line every three years somewhere. More nuclear reactors also will increase the potential for an accidental release of nuclear waste into the atmosphere/ environment. For example, the Three Mile Island incident in 1979 involved a partial core meltdown, and according to the calculations if many more reactors are built the likelihood is that more accidents similar to this one will occur by mid-century. Schulz (2006), a senior fellow at the conservative think tank Manhattan Institute for Policy Research, has tried to counter this argument by pointing out how the coverage of Three Mile Island was hyped and biased in a way that played to peoples' irrational fears about nuclear waste and radiation exposure. Schulz notes not only did not one person actually die from the Three Mile incident, but nobody was even injured. This was due to the fact that even though there was a partial core meltdown the concrete containment structure worked exactly as intended, and no nuclear waste leaked into the air or water. He points out that every energy source has its dangers, but that the upside of nuclear power easily outweighs its drawbacks and that spent nuclear fuel should be safely and finally disposed at the Yucca Mountain facility.

Several investigations have been done assessing the viability of transportation of nuclear waste to Yucca Mountain, and these studies are not without controversy. Halstead (2002), Transportation Advisor for the State of Nevada's Agency for Nuclear Projects, points out that the vast majority of spent fuel to be sent to Yucca would give off

extremely deadly radiation, which will require shipping casks with extraordinary shielding. Even with such shielding the casks will still emit radiation that would pose serious long term health risks to the transportation workers and inspectors. There is also the ever present danger of a catastrophic release of radiation from the shipping casks in the event of a natural disaster, accident or terrorist attack. Such an event could pollute the environment in a way that could potentially cost billions to clean-up, as well as endangering the health of thousands of the public. Merrifield (2006) of the U.S. Nuclear Regulatory Commission indicates that the fears associated with transport are unfounded and indeed are well-crafted 'myths'. He does not believe the level of exposure to radiation from shielded casks would be excessive in anyway whatsoever to people associated with the transport of the wastes, people living near the shipment routes or even near the repository itself. He also discounts that the casks would present a major concern to public safety in the event of an accident or sabotage. He says it would be highly implausible, even in the unlikely event that a shipping cask ruptured on the way to Yucca, for very much of the spent fuel to be released. In short most of the radioactive contents would remain intact within the inherently-stable structure of the durable casks and not pollute the environment.

The long term implications to U.S. energy policy and politics over the Yucca Mountain dispute cannot be overestimated. According to Corbin (2007), who has worked on American Indian film programming at the Smithsonian, this project represents 'environmental racism' of the worst kind; in effect- creating a nuclear waste dumping ground right in the middle of their ancestral homeland. While the land is considered a convenient, desolate and remote outpost for the storage of deadly waste products by the

U.S. Government/power elite, it holds great spiritual significance for the Shoshone and the Paiute. Typical of other disputes with the American Indians throughout this country's history, their treaty rights to this land are being ignored and false expectations about how 'safe' this repository really would be are being created by the government representatives, sponsored scientists and DOE personnel.

Political muscle has been exerted time and again by governmental entities. For example, Inhofe (2006) a Senator on the Committee on Environment and Public Works, notes that the decision for Yucca is based on sound science, and not motivated by political concerns. Inhofe indicates that further delay of this project may burden the public with excessive costs in the billions, and interjects how failure to implement Yucca may negatively impact national security and energy policy for decades to come. In short, he says the creation of Yucca will be a showcase for the world that will allow for safe disposal of nuclear waste, and at the same time promote a beneficial rise in the demand for nuclear energy; therefore allowing us to lessen our dependence on foreign sources of energy from dangerous parts of the world. But is there a radically different path that we as a country might take i.e. one that would not require a Yucca Mountain at all? Perhaps. Flavin and Sawin et al. (2006), President & Project Director of the World Watch Institute, highlight a comprehensive plan for the 21st century, which is predicated on renewable 'green' forms of energy; therefore negating the necessity for Yucca and all its inherent 'baggage'. According to them achieving energy security, reducing global warming, and meeting the growing energy needs of the public/industry can all be met through an aggressive combination of renewable resources and emerging technologies- none of which involve nuclear power, centralized power grids and dangerous waste

products that require long term disposal/storage. For Flavin and Sawin et al. (2006) the moment for this change in thinking and behaving is now and if the public can be sufficiently convinced that their vision is the correct path, then it will help ensure a clean energy future for all.

Findings: Ramifications on if Yucca Mountain Becomes a Reality or not

From the dawn of the nuclear age, reactors have been generating large volumes of left over by-products. The question remains: what to do with all this nuclear waste? While every country that utilizes such a power source has to deal with the problem, the U.S., has had to handle it for the longest period of time which is since the early 1950's. Headed by the U.S. Department of Energy (DOE) the ideas on how to dispose of such a toxic substance varied greatly. Some hypothesized it might be best to bury the waste in the deep ocean sediments, but there were concerns about it eventually leaking into the water over time and spreading uncontrollably far beyond the original 'sink point'. Another possibility that was seriously considered was to 'shoot it into outer space', but the problems here were numerous including concerns about would happen if a launch rocket were to fail; thereby releasing the deadly cargo into the atmosphere and endangering the public.

The supposed 'final answer' came in the early 1980's with the adoption of the Nuclear Waste Policy Act of 1982 when scientists began to study Yucca Mountain as a possible geologically 'suitable' repository for the nation's nuclear waste. The framework of the NWPA proposed at least two repositories located in different parts of the country to promote fairness and equity according to Zacha (2006, p.13); however, this has not been the case and "since 1987 it has been the only site considered for 77,000 metric tons

of spent nuclear fuel intended to store 98% of radioactive waste generated by U.S nuclear reactors" (Shundahai Network, 2006).

There has been wide-spread opposition to Yucca, which has delayed the opening of the project; however, in 2002, President Bush and Congress approved this mountain for use as the repository of choice. The DOE is currently planning to submit a license application to the NRC by June 30, 2008 that if approved will be the last legal hurdle in the construction of the project. Let us note, though, that 'unofficial' construction of the massive project spreading over 230 square miles has already been underway for some time, and is scheduled to be completed by the year 2017 according to the Alliance for Nuclear Accountability (2007). Despite the government's push for the project, those in opposition of the project also continue to voice their concerns and they range across a wide variety of fundamental issues.

Perhaps the most important scientific reason given by the experts for picking Yucca Mountain over other sites is it is thought to be 'geologically stable'; however numerous arguments have evolved that challenge this theory including:

(a) The Nuclear Waste may Infiltrate Nearby Groundwater:

The U.S. Department of Energy (DOE) claims that the site, with an average of only 7.5 inches of precipitation per year, is not only 'bone dry' but is far from any water tables or underground aquifers. In fact it is so removed from ground water that there is little probability that water from under the mountain could ever effect nearby neighborhoods, or such a large city as Las Vegas. The DOE adds that not only are there 'minute' amounts of precipitation, but even the water that does hit the mountain is quickly evaporated and thus does not penetrate downwards. There should be no concern,

according to these governmental researchers, as “these groundwater basins have been separated for millions of years”; in addition, there are engineered barriers within the mountain for protection so even if there were a leak of radioactive waste from a storage container “the waste package and support pallet, would contain crush tuff that would also delay the transport of radionuclide into the unsaturated host rock” (U.S. Department of Energy, 2007, p.9). In short, it would remain ‘trapped’ inside the dry mountain chambers leaving it virtually no chance of going anywhere.

As it turns out, recent research by the Public Citizen indicates that water contamination is much more probable than expected. First they note that while the site appears to be consistently dry in that it only averages ~7.5 inches of rain per year, in reality the site is not ‘dry’ when one considers the manner in which the rain falls. In short, the “rainfall at Yucca occurs frequently as torrential storms, that can often result in erosion and flooding” (Public Citizen, 2005, p.5); thus the mode of rain delivery can ultimately result in greater penetration of the mountain than originally predicted. In addition, their study confronts the issues with ‘so-called’ barriers. They note how initially, the DOE was aiming to rely solely on ‘natural barriers’ i.e. to contain the waste, but after further study even the government scientists realized that it would not be sufficient to safely hold the waste for thousands of years. This is why the DOE decided to resort to an engineered barrier system. The question is though, are these barriers reliable? “The DOE talks about disposing of nuclear waste but nuclear waste cannot be disposed of, it can only be stored- in which case there is always the danger that radiation will escape” (Public Citizen, 2005, p.5). Leakage of waste into the water is a potentially huge problem because this aquifer serves both the people of Amargosa Valley as well as Nevada's

largest dairy farm, which is a farm that supplies milk to over 30 million people on the West coast.

(b) The Site is 'not' as Geologically Stable as Advertised, but in Fact is Subject to both Volcanic Activity and Earthquakes:

According to the DOE, Volcanic experts (Volcanologists) have carefully studied the site to determine how volcanic activity may impact the repositories future. To do this they gathered data from similar 'regional' volcanoes and applied it to computer models to help them better understand Yucca's volcanic centers. The study concluded that the chance of the repository being disrupted by a volcanic event is extremely small "about 1 in 70 million, or a chance of 0.0000014 percent per year" and note that the last 'small' eruption was nearly 80,000 years ago, according to the U.S. Department of Energy (2007, p.12).

The DOE does admit the high probability of earthquakes taking place at the repository, but at the same time point out how the mountain's internal structure has resisted damage from earthquakes for hundreds of thousands of years. Since the repository has been under construction, underground observations through the tunnels "have revealed little disturbance from historic seismic events" (U.S. Department of Energy, 2007, p.13). For any large earthquakes that may occur in the future, they assure that the depth of the repository, which is located ~1,000+ feet underground, would help prevent any damage to the containers as the surrounding rock would absorb the harshest vibrations with little if any effect on the containers. In addition, they add that the construction of the facility itself is being built according to Nuclear Regulatory Commission regulations that require they be able to withstand the effects of natural

phenomena such as large earthquakes.

The Public Citizen (2005) begs to differ with these claims. They highlight the importance that just 80,000 years ago the last volcanic eruption took place and claim that there is much uncertainty by geologists regarding future volcanic activity at the site. Is it imminent or not? Given that there are several volcanic cones near Yucca Mountain, they believe more studies must first take place, because if just one of the volcanic cones were to become active, “magma could enter the underground tunnels and cause the canisters to fail instantaneously, releasing radiation into the groundwater or in the case of a major eruption, to the air as contaminated ash” (Public Citizen, 2005, p.6, see reference table 1 & 2).

While the DOE contends the facility to be safe from seismic activity, the Public Citizen (2005) believes this is a ‘grey area’ given the number of earthquakes that have taken place. Their studies show that “since 1976, there have been more than 600 seismic events of a magnititude greater than 2.5 within a 50-mile radius of Yucca Mountain and to date Nevada ranks third in the nation for current seismic activity” (Public Citizen, 2005, p.6). In fact, in 1992 a 5.6 magnitude earthquake struck the site causing damage to a nearby DOE field office building. This is of great concern not only because of the possible initial damage that may occur to the stored spent fuel, but the other ramifications i.e. groundwater levels that could significantly rise as a result of a seismic event; thus leading to a possible flooding of the repository (Public Citizen, 2005).

Why would the DOE continue to push for a project when there appears to be so much study that needs to take place in order to determine whether or not the mountain is truly scientifically sound? According to recent findings by the State of Nevada, they had

much reason for further deliberation. As a prime example: in 1996 scientists working on the site discovered that a radioactive isotope from the period when nuclear weapons were tested in the atmosphere had actually penetrated into deep layers of Yucca Mountain; thus indicating that water, which was the 'vehicle' carrying the isotope, could percolate downward much faster then previously thought. This unanticipated 'fast pathway' of water inside of Yucca created some real issues, for it meant that the site would not qualify under their own guidelines as a safe repository (State of Nevada, 2005).

In 2004, the DOE, in a request by the Nuclear Regulatory Commission (NRC) filed and posted a number of emails between scientists working on the site under the United States Geological Survey Team (USGS). The period of time for the e mails ranged from 1996-2000, and while the "NRC later ruled that DOE's filing was incomplete and inadequate the emails are still very revealing" according to the State of Nevada (2005, p.1). Below are two examples of the emails between members working on the site in reference to the water tests and overall safety of the mountain:

(1) 1998-02-24 Ed Taylor to Robert Andrews

Re expert opinion—quotes expert Lynn Gelhar statement to NWTRB:

"From my [Lynn Gelhar's] perspective the saturated zone activities in the YMP suffer from a modeling deluge and a data drought. If the project is expected to meet the normal standards of scientific fact finding, I feel that the project faces some very difficult challenges. On the other hand, if the strategy is to use complex, pseudo-sophisticated modeling techniques primarily to obscure the real limitations of the existing information, the project would seem to be on the right course" (State of Nevada, 2005, p.15).

(2) 1998-12-17 [Blacked out] to [Blacked out]

Re: AP 3.10Q

"This is now CYA and we had better be good at it. I seem to have let this one slip too much in an attempt to cover all our work (and get us the hell out of the long term problem of Yucca Mountain). . . These are very dangerous times, both funding wise and professionally. Mark my words on this one, it will not be long before our technical credibility with [will?] be challenged in an attempt to discredit us and redirect funding! . . ." (State of Nevada, 2005, p.18).

As a result of these findings, a hearing by Congressman Jon Peter was held "upon revelations that certain Yucca Mountain investigations performed for DOE by the USGS may have been falsified" (State of Nevada, 2005, p.1). The consequences of 'fast paths' for water downward in the mountain and the subsequent attempts to hide or potentially falsify this information from the public by Yucca 'experts' is troubling to say the least, and deserves further analysis.

Transportation of the waste remains a major 'sticking point' as well. It is estimated that moving the 77,000 tons of nuclear waste from nuclear plants all over the country to Yucca Mountain will not only take vast amounts of time, an estimated 38 years by the DOE, but also could be quite risky. In virtually all cases it is envisioned that the waste will be moved via truck, barge or railway systems. Jeffrey S. Merrifield (2006), who is commissioner of the U.S. Nuclear Regulatory Commission, challenges the skeptics who claim that the containers, which will transport the fuel rods are unsafe and vulnerable to impact. He points out that the fuel rods have in fact survived a variety of impact tests that were completed by the Sandi National Laboratory. These tests include "an impact from locomotives traveling at 80 miles per hour, engulfing them in a jet fuel

fire and dropping them from 30 feet onto a concrete surface" (Merrifield, 2006). He also touches on the NRC track record as they have safely delivered over 1,300 spent fuel shipments during the past 25 years. In the very unlikely scenario where a large explosion may take place, Merrifield assures that "only a minute amount of radiation would be released as the majority of the fuel would remain in the general area of the initiating event" (Merrifield, 2006).

Robert M. Halstead (2002) who is the transportation advisor for the state of Nevada's Agency for Nuclear Projects, on the other hand, highlights his concerns. First he questions the true reliability of the 'waste caskets' by highlighting the Baltimore rail tunnel fire of July 2001, which "burned for more than three days with temperatures as high as 1500F" (Halstead, 2002). Also, according to Halstead, in a Nevada-sponsored study, if this had been a radioactive fuel rod container, for the design is similar to the ones that will be traveling to Yucca Mountain, it would have resulted in a 'significant' release of radioactive materials. In fact, enough to contaminate an area of 32 square miles and expose people to radiation levels, which could cause many types of cancers (Halstead, 2002).

Health risks from transportation accidents are not the only issue, because as a result of a major 'incident' there could be huge clean up costs. A spill of such an incredibly toxic substance with such a long half life would conceivably cost anywhere from $300,000 to $ 10 billion dollars to clean-up i.e. as adapted from Halstead (2002). This would have to be paid ultimately by U.S. taxpayers; thereby causing a major drain on valuable financial resources. An interesting point here is that through powerful lobbies and corporate influence the liability of the nuclear industry itself is 'strictly limited' i.e.

they would not be held responsible for the full ramifications and outcome of such a terrible event. In addition to simple accidents there is also in this post 9/11 world the real potential of shipments being strategically targeted by well-armed terrorists, which would suit their aims of spreading fear; thus potentially killing many American citizens in one single event, and causing economic catastrophe to our capitalistic system. Millions of citizens, traumatized by such an event, would potentially alter their financial and social behaviors all over the U.S. and make decisions based on their emotion rather than reason.

In addition, while the overall track record for nuclear shipments has been good to date given the limited number of trips, Halstead (2002) points out how the odds of health risks and terrorist attacks increase when taking into account the number of shipments that would take place over the planned 38 year span. Given truck shipments alone, he estimates that there would be greater than 108,500 cross-country trips of spent nuclear fuel and high level radioactive waste during the course of this near four decade period. That calculates at 2,855 truckloads per year. Based on estimated transportation routes by the DOE, more than 123 million people in 703 counties will live near these planned truck routes, with another 106 million living in counties along the rail routes, which have yet to be constructed. Overall, the DOE predicts that between 10.4 and 16.4 million people will live within one-half mile of a transportation route by 2035 according to Halstead (2002). This movement scheme literally places millions of people within close proximity of any undesirable nuclear waste release incident (See reference table 3).

There are other important issues to consider as well. For example, the U.S. government fails to acknowledge that once nuclear waste reaches Yucca Mountain, it will be infringing on sacred Indian Land belonging to the Western Shoshone. According to researcher Amy Corbin (2007), “the Western Shoshone nation claims sovereign rights

over 60 million acres within the geographical confines of Nevada, Idaho, Utah and California" (History section, para.2). Even though their territory has been greatly reduced with the U.S. government now claiming 80 – 90% of it, they continue to cherish the land that remains under their control, for it holds great spiritual meaning to them. While the Western Shoshone are no stranger to government oppression i.e. mining and other military tests, this proposal from the start has stirred an uproar throughout the Shoshone and other Native American communities. They are fed up with the U.S. government's attempt to claim or otherwise contaminate their ancestral land via the Yucca project. This strong unrest continues, in spite of the fact that the government has tried to 'buy them off' by offering their community large compensation packages. An example in this case can be seen from 2004 when the Bush administration, in an effort to justify their actions, offered a 145 million dollar settlement when developing the 'Western Shoshone Distribution Bill' (Corbin, 2007). "Some in the community thought they should accept the money since they believed there was no chance of regaining the land" (Corbin, 2007, Threat section, para.6). They also knew it would make them wealthy for years to come; however, Corbin adds that the majority of the Shoshone to this day believe that no price can be placed on their ancestral lands.

Also, they believe that the government is not only violating human rights but 'flat out' breaking the law as well. Their battle for sovereignty includes issuing multiple lawsuits, which claim that the issue involves both human and ecological rights. They refer to the '1863 Ruby Valley Treaty' signed by Abraham Lincoln, which guaranteed incoming settlers and military personnel safe passage through The Western Shoshone and other Indian territories (Corbin, 2007). They are in essence, a sovereign

nation that under international law holds the same territorial boundaries as those of Canada or Mexico.

The raging debate surrounding Yucca Mountain does not just involve the site itself, for many are concerned about the possible ramifications if it were to actually 'open for business' as planned. In short, with the government pacifying peoples' fears/biases against the storage of radioactive waste, and by illustrating how it can now be stored safely virtually forever and 'out of sight' then this could eventually lead to the issuing of more licenses and construction of more nuclear power plants to feed the ever growing national appetite for energy. Since the early 1970's not a single new nuclear power plant has been licensed, built, and put into operation within the geographical confines of the U.S. A major reason for this fact is that the government has been unable to placate peoples' perceptions that nuclear waste can be safely stored in any area for excessively long periods of time. These fears were exacerbated even further with actual incidents including e.g. the accident at Three Mile Island in 1979, which involved a partial core meltdown, and the release of radioactive energy into the atmosphere. This incident was closely linked in time, ironically with a major movie blockbuster 'The China Syndrome' that further turned the public against the prospects of a nuclear energy dominated future. In practical terms, aside from the public hysteria, the Three Mile incident led to the collapse of the Chemical Bank and made Wall Street 'skittish' about financing any more nuclear power plants. Major insurance carriers also refused to offer any coverage to those venture capitalists who would want to build such plants. Bruce Smith, and Arjun Makhijani (2006) touch on this by claiming that the 'root cause' of the Three Mile accident should serve as a leading example as to why nuclear power is simply not worth

the risk, even though it was not a full-blown, radioactive catastrophe.

Confronting those who support the notion that the construction of new power plants would be good and could help to combat the threat of climate change, they say this is impractical as an estimated “2,500 nuclear plants would be needed by mid-century”, to put this into perspective, “one plant would have to be constructed and come online somewhere in the world every six days between 2010 and 2050” (Smith & Makhijani, 2006). Even with the assumption that these new nuclear plants could be built safer than say the older Russian style plants such as Chernobyl or today’s U.S. plants , they estimate the likelihood “of better than one chance in two that at least three accidents comparable to the one at Three Mile Island would occur by mid-century”. In addition, “one repository the size of Yucca Mountain, would have to come online somewhere in the world every three years” just to absorb and store the increasing amounts of generated nuclear waste (Smith & Makhijani, 2006).

Despite these facts, there are those who support the expansion of nuclear power and downplay the significance of the Three Mile Island incident, or the even more severe Chernobyl ‘blow up’. An example is well illustrated by Max Schulz (2006), a senior at the Manhattan Institute for Policy Research, who in reference to ‘Three Mile Island’ reminds us that “nobody died or was even injured” (Schulz, 2006). In addition he claims the nearby community was never really endangered because the concrete containment structure of the nuclear facility was built to the same standard of all nuclear reactors to ensure that no radiation was leaked. Schulz (2006) nevertheless addresses the issue of nuclear waste and says “failure to open Yucca Mountain or otherwise to solve the waste question could force some reactors to shut down and discourage investors from

supporting new nuclear plants" (Schulz, 2006).

If Yucca Mountain opens as scheduled in 2017, it may lead people to believe the hype that the site has been classified as 'safe' by our government and trusted scientific figures. As such, the public will be more easily 'swayed' to consider the construction of more nuclear power plants. After all, we would have a place to store the waste virtually 'forever' in an undisturbed state. This in turn can lead to more rationales and reasons being given for the development of such a repository. For example, Senator James Inhofe (2006) in a government study, insists that the project's continuation is essential for a couple reasons, which include the following:

(1) Security: The future energy security of America will rely largely, in part, on nuclear power and highlights a statement by President Bush in June of 2005 when he said "It is time for this country to start building nuclear power plants again"(p. 25). Soon after this statement, "a strong bi-partisan majority in Congress agreed, passing a comprehensive energy bill that included significant incentives for new nuclear power plant construction" (p. 25).

(2) Cost: The government has already spent over "$8 billion on the Yucca project and will spend another $49 billion based on current cost estimates" (p. 23), that if delayed will come at an ever burdening cost to the taxpayers. It is essential to our national security and will ultimately save money if we move quickly, quoting Secretary Abraham, former head of the DOE, "By moving forward with Yucca Mountain, we will show leadership, set out on a road map , and encourage other nations to follow" (p. 25).

If the energy policy of the U.S. continues on this same path, i.e. led by the incessant push for the Yucca facility, than the vast amounts of money and resources that

would need to be spent on nuclear energy and its safe disposal/storage may place capital, which would otherwise be available for 'green' energy like wind, solar, geothermal and hydro, on the 'back burner'. Nuclear proponents say 'so what' even with a best case scenario there is no way that green forms of energy could truly surpass nuclear energy in satisfying our national energy and security needs. Why invest in green when it will not get you very far? Not so fast the advocates of alternative forms of energy say. According to Christopher Flavin and Janet L. Sawin et al. (2006) of the World Watch Institute, in another study, alternative supplies can be the solution if we would only take full stock of the potential for clean forms of power; sources of power that would not require a Yucca Mountain. While renewable energy sources at the moment provide the U.S. with only 6 % of total energy consumption needs, they note how the technologies are evolving quickly and if put into full utilization, i.e. through massive investments by the public and private sectors, it is likely that these 'green' forms could serve virtually all our energy needs (Flavin & Sawin et al., 2006). Several examples they give include the following:

(1) Wind Power: "The wind resources of Kansas, North Dakota and Texas alone are in principle sufficient enough to provide all the electricity the nation currently uses" (p. 36).

(2) Solar Power: "A little over 4,000 square miles –equivalent to 3.4 percent of the land in New Mexico would be sufficient to produce 30 percent of the country's electricity" (p. 30). In addition, it is estimated that if solar panels were placed on just half of the "6,270 square miles of roof area and 2,350 square miles of facades" this would be enough to supply another 30 percent of U.S. electricity (p. 30).

(3) Geothermal: It is calculated that "just 74 acres of land are needed to generate one

billion KWH of electricity annually, enough to power nearly 94,000 American homes" (p. 30).

Flavin and Sawin et al. (2006) continue to explain how "U.S. renewable energy policies over the past two decades have been an ever changing patchwork. Abrupt changes in direction at both the state and federal levels have deterred investors and led dozens of companies into bankruptcy" (p. 7); however, it is evident that the tide is turning as many "U.S. states now have incentives in place to promote renewable energy. For example, more than a dozen have enacted new renewable energy laws in the past few years and four states strengthened their targets in 2005, signaling fresh political momentum. If such policies continue to proliferate and are joined by federal leadership, rapid growth is possible" (p. 7); thus instead of a nuclear fueled future tainted by the dangers of radioactivity and expensive long term storage of toxic substances on the order of thousands of years we could be looking at far less complicated, cleaner, and environmentally compatible future. One that combats climate change, but without the 'headaches' brought on by all the factors that come with imperfect nuclear repositories.

Interestingly enough, even the mantra posed by the nuclear proponents that the push for Yucca and beyond will help secure our national security is also flawed. Flavin and Sawin et al. (2006) point out succinctly that America's current energy system (actually) undermines national security. "The centralized and geographically concentrated nature of the country's power plants, refineries, pipelines and other infrastructure leaves it vulnerable to everything from natural disasters to terrorist attacks" (p. 9). It is clear that centralized power grids, dependent on potentially vulnerable nuclear power plants and waste transport routes/storage areas- would hardly serve to heighten our

security.

Conclusion: Lessons Learned

In the looming battle over Yucca Mountain who ultimately will prevail in the setting of public policy on this subject may very well be the interest group(s) that best: define the problem using their particular biases and criteria; control the flow of information; and develop/select the alternatives from which the people can choose. Ironically, the more choices that are promulgated regarding the efficacy or futility of using Yucca Mountain, as a waste depository, it may result in a less than satisfactory decision on the project or a failure to make any decision at all (i.e. 'paralysis by analysis'). Both nuclear and green energy advocates are making powerful efforts to influence the public and affect the political decisions, which are yet to come.

These decisions that will have a bearing on where we plan to go as a civilization in terms of energy policy, patterns of energy consumption, and its impact on people and the surrounding environment. On the one hand we have the tantalizing potential of seemingly unlimited amounts of nuclear energy at our 'fingertips', if we could just get over our fears of nuclear waste. In a somewhat bizarre sense Yucca is literally a 'Heaven on Earth' when it comes to the storage of nuclear waste. Yucca Mountain is not just a geographical entity, but a concept an idea that there can be a safe haven from the unbelievable toxicity of these wastes; a place that is virtually untouchable, out of sight, and offers an 'eternal' resting place for these substances. In reality, though, there really can be no such place. Nothing on Earth made by Man endures. Even the Pyramids eventually crumble, and what hubris is it that thinks we can actually create a repository that could safely last for 10,000 years or more! It would be more sensible to go in a

different direction. One that avoids a future filled with the anticipated ‘dread’ of a nuclear incident, accidental contamination and radioactive release into the air and groundwater, or a terrorist-induced release of nuclear waste. There is little doubt, based on all the findings that green energy can in fact help to counter climate change, while fulfilling our growing energy appetite, and ultimately serve as an example to the world towards a cleaner, safer way of life.

References

Alliance for Nuclear Accountability. (2007, Spring). Retrieved March 9, 2008, from http://www.ananuclear.org/Portals/0/documents/Fact%20Sheets/Yucca%20FS%202007.pdf

Corbin, A. (2007, September). *Sacred Land Film Project*. Retrieved February 18, 2008, from http://www.sacredland.org/endangered_sites_pages/yucca_mountain.html

Flavin, C., Sawin, J. L., Mastny, L., Aeck, M. H., Hunt, S., Macevitt, A., & Stair, P. (2006). *American Energy, The Renewable Path to Energy Security* (Rep.). Washington D.C.: The World Watch Institute.

Gowda, R., & Fox, J. C. (2002). The Fundamentals of Behavioral Decision Theory. *Judgments Decisions and Public Policy* (pp. 9-71). Cambridge, Massachusetts: Cambridge University Press.

Halstead, R. M. (2002, April 25). *Yucca Mountain*. Retrieved February 17, 2008, from http://www.yuccamountain.org/leg/halstead042502.html

Inhofe, J. M. (2006). *Yucca Mountain: The Most Studied Real Estate on the Planet* (Rep.). D.C., Washington D.C.: U.S Senate Committee on Environment and Public Works.

Merrifield, J. S. (2007, February 22). *U.S. Nuclear Regulatory Commission News*. Retrieved February 16, 2008, from http://www.nrc.gov/reading-rm/doc-collections/commission/speeches/2006/s-06-007.html

Public Citizen. (2005, January). Retrieved February 15, 2008, from http://www.citizen.org/documents/YuccaBackgrounder05.pdf

Schulz, M., Smith, B., & Makhijani, A. (2006, Autumn). Nuclear Power: Both Sides. *The*

Wilson Quarterly, *30*, 59+.

Shundahai Network. (2006, November 5). Retrieved March 10, 2008, from http://www.shundahai.org/yucca_mt.html

Stan Deyo. Retrieved March 17, 2008, from http://standeyo.com/News_Files/UN_Images/Yucca.Mtn.routes.bet.med.gif

State of Nevada. (2005, May 9). Retrieved March 15, 2008, from http://www.state.nv.us/nucwaste/news2005/pdf/ymchron01.pdf

U.S Department of Energy Office of Public Affairs. (2007). Retrieved February 14, 2008, from http://www.ocrwm.doe.gov/ym_repository/sr/faq.pdf

Zacha, N. J. (2006, May/June). What's Next for Yucca Mountain. *Radwaste Solutions,* 12-17.

Appendix

Table 1: (Public Citizen, 2005, p.12)

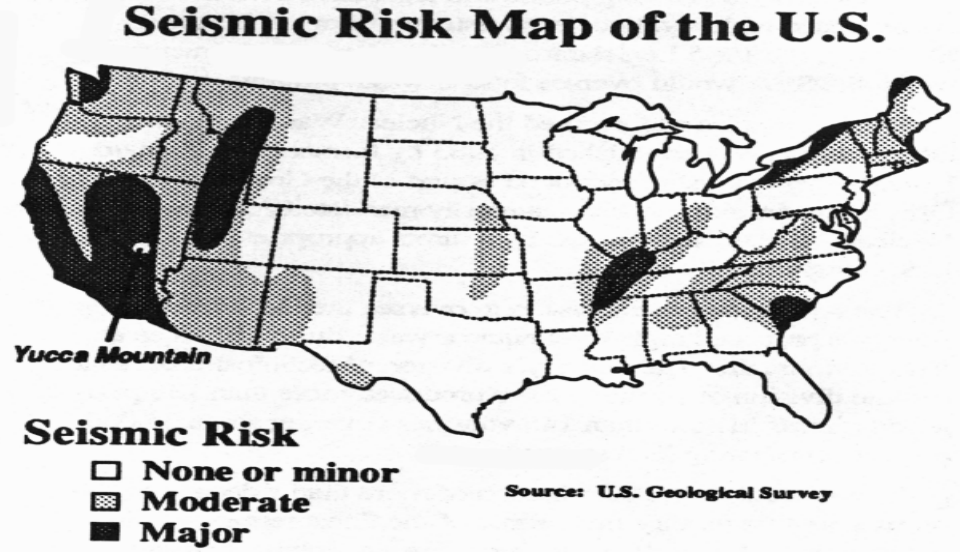

Table 2: (Public Citizen, 2005. p.12)

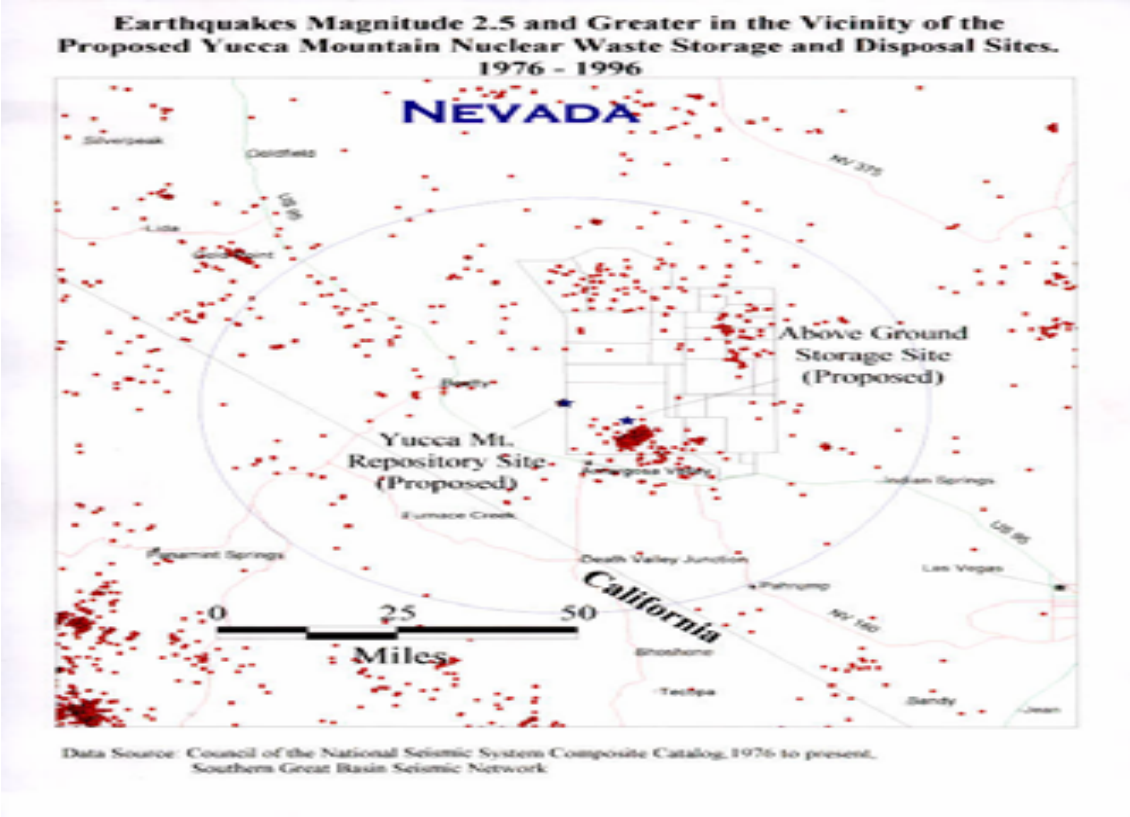

Table 3: (Stan Deyo)