THE FENCES OF THE NATIONAL REACTOR TESTING STATION: INTERSECTIONS OF POPULAR CULTURE AND NUCLEAR WASTE IN EASTERN IDAHO

by

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DEDICATION

Dedicated to Greg and Marie Collier who always allowed me to explore my talents and taught me not to be afraid to ask questions.

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ABSTRACT

In the spring of 1949, Idahoans made a decision that forever altered the character of Eastern Idaho. The decision to embrace the US Atomic Energy Commission's (AEC) latest project, the National Reactor Testing Station, was a momentous one. Idahoans living near the proposed site counted on this decision to bring a treasure trove of economic benefits to the surrounding rural communities. By the 1970s as increasing information about the costs of the AEC's nuclear waste disposal programs became public many in Idaho found themselves shifting from overwhelming support of the AEC to a sort of middle ground. These Idahoans were careful to make clear that they supported the broad nuclear project within the state what they opposed was the AEC's nuclear waste disposal in the state of Idaho. This meant that in Idaho a total opposition to nuclear research never materialized at a time when anti-nuclear sentiment rose sharply throughout the broader US. The overwhelming opposition to Yucca Mountain Waste repository by the people of Nevada is the contrast to Idahoan's unique position of opposition balanced with accommodation. By tracing the history of these two projects and showing how Idahoans reacted in complex ways to the mounting information about the problems surrounding the AEC's nuclear waste disposal programs, important lessons are revealed about the ways local knowledge, scientific knowledge, and mass media interacted in the American West to create different environmental ethics.

INTRODUCTION

For most people, driving through the Snake River Plain in Southern Idaho is an exercise in tedium. It is a landscape of seemingly endless sage scrub marked by only the occasional butte or canyon to break up the monotony. This is why the drive west on U.S. Route 20, from Idaho Falls to Arco, is such an odd experience. For the most part, this highway is like all other highways that crisscross the Snake River Plain. There is, however, one exception. About thirty-eight miles into the drive, you crest a small hill and a few miles off in the distance see a large industrial complex surrounded by nothing but sagebrush. Few drivers take the time to think deeper about why an industrial site like this is located in the middle of the high desert, miles from the nearest town. People often put this incongruity of a sparse uninhabited desert scape with an industrial landscape out of mind by the flip of a radio dial or a push of the gas pedal to pass an agonizingly slow semi or R.V. In some instances, however, dismissing the incongruity is not easily accomplished.

My own experience with this site is a long one. I first stumbled upon the Idaho National Engineering and Environmental Laboratory as a freshman in college.[1] This fateful encounter happened quite by accident. On a warm night during the summer of 2003, I was driving back from Boise to Rexburg with a group of friends. Over the course of the four-hour drive, we had exhausted the typical topics of college students. The inky

1. When I first encountered the site in 2003, the laboratory was called The Idaho National Engineering and Environmental Laboratory (INEEL). The name has since changed to The Idaho National Laboratory (INL). For the majority of the time covered in this paper the site was called The National Reactor Testing Station (NRTS). It was also known as the Idaho National Engineering Laboratory (INEL). All four of these names refer to the same government site in Eastern Idaho.

blackness of that night on the Idaho desert crept into the car and our discussion turned to darker things; we told ghost stories designed to set nerves on edge. The intensity of the conversation was distracting and the driver missed a junction on the highway. A few minutes later, one of my friends saw something on the side of the road and asked, "What's that?" At just that moment, a jackrabbit jumped out in front of the car and one of the girls riding with us let out a loud scream. As we continued, we soon found the road flanked by tall chain-link fences topped with razor wire. Lights appeared in the distance and illuminated a military-style guardhouse blocking the road. A sign informed us that a restricted area lay ahead and that all unauthorized vehicles should turn around. We quickly obeyed the warning and got back to the highway as soon as we could. The rest of our drive was oddly quiet as we all tried to make sense of what we had stumbled across in the middle of the Idaho desert. What none of us really understood at the time was that the unnatural landscape we experienced that night was part of a sixty-five year old nuclear facility known today as the Idaho National Laboratory. This chance encounter would haunt me in odd ways for years to come. As I continued through my time in Eastern Idaho, I would occasionally confront the Idaho National Laboratory through chance encounters and casual comments; however, I was never truly able to understand what we saw during that road trip as freshman. This experience provided the impetus to delve more deeply into the history behind this site and the controversies surrounding it.

Traveling out to the national laboratory site today is a much different experience. During a drive around the public roads that crisscross the National Laboratory, the discerning observer will notice many road signs that reflect the nature of the nuclear

West. The most prominent signs on large roadside billboards proclaim that you are "Entering INL Industrial and Research Complexes." If you turn off any of the highways that cut across the site, you will come across other large signs with a more ominous tone that state, "RESTRICTED AREA admittance only for official business." In addition, these signs also bear the seal of the United States Department of Energy as a way to provide all the weight of federal authority. Signs like these serve as tangible reminders that while public roads cut across the Idaho National Laboratory, this site is not fully open to the public.[2] Although most of the work that takes place in America's National Laboratories is no longer classified, relics of Cold War sensitivities towards nuclear secrecy remain. From the opening of the National Reactor Testing Station (NRTS) in 1950 until the mid-1960s, much of the work that went on at the testing station received a bold-red classified stamp and security was always tight. Today, only traces of that more secretive and militarized past exist. Much of the legacy of that earlier time is now invisible, hidden from the view of the average citizen. The militarization of America's Western landscape during the Cold War has created a contemporary landscape that is layered, complex, and in many ways problematic for the American public. The secrecy that has always shrouded such sites has had important impacts in both the landscape of the areas surrounding these places and in the local responses that developed to deal with the particular impacts that arose. The enduring legacies of the Idaho National Laboratories occur on two time scales. On the one hand, when the Atomic Energy

2. The national laboratory does offer tours of selected areas for groups of ten or more, but they require everyone to go through a background check before they can pass through the sites security checkpoints.

Commission (AEC) buried waste around the NRTS without public knowledge, they created a legacy measured in the half-life of dangerous nuclear material. Transuranic materials have radioactive half-lives that can range from 8 seconds for the highly unstable isotope Seaborgium^{265} all the way up to billions of years for an isotope like Plutonium^{244}. Within the context of radioactive waste products timescales for disposal and isolation are both very short and very long. This reality created many challenges for the AEC as they sought to organize their waste management program in Idaho. On the other hand, the people living around the NRTS expressed a unique local response, a mixture of cooperation and opposition, to deal with the inherent incongruities of life next to a secret facility. In a largely rural Eastern Idaho landscape, the rhythms of life fell somewhere in the middle. This was not the frenetic pace of highly unstable isotopes, or the barely imaginable geologic timescales of other isotopes. These enduring legacies, one toxic, obeying physical properties, the other cultural, obeying the rhythms of a small Western community, are the subjects of this study.

Understanding what the Idaho public knew about the dangers of both nuclear research and waste, and when they knew it, can be difficult to reconstruct. In order to make sense of the history of nuclear waste in Idaho, this study explores four categories of historical analysis. To start, exploring the early history of the NRTS will allow for a better understanding of the cost-benefit calculation that took place in Idaho communities, and why Idahoans were not initially concerned about the dangers of nuclear research and the nuclear waste that accompanied it. Secondly, this study investigates the origins of nuclear waste disposal at the NRTS and how ideas about both waste disposal and

environmental isolation evolved over time. Then, we shift our attention to an exploration of how opposition to nuclear projects began in Idaho. More specifically, the ways that a changing local understanding of nuclear waste led to a different cost benefit analysis that allowed for opposition to nuclear waste on environmental grounds. The final section explores the ways in which nuclear fears manifested themselves in the broader thinking of the American public. Then we move to a more specific analysis between the ways nuclear opposition manifested itself in the 1980s in Nevada as opposed to the more nuanced opposition in Idaho.

While opposition to nuclear projects in the Western US became widespread in the latter half of the 1970s and throughout the 1980s, historians have not adequately explored the different ways this opposition developed and manifested itself. This study takes important steps towards unpacking the larger nuclear story of the Western U.S. by contrasting the type of total opposition that materialized in response to Nevada's Yucca Mountain Nuclear Waste Repository with the complex economic and environmental calculations that occurred in Idaho. What transpired in Idaho is in some ways unique because the cost benefit analysis towards nuclear projects rarely fell on the side of total opposition as it would later in Nevada with regards to the Yucca Mountain Waste Repository. While the types of analysis that developed in these two states differed, they were also inseparably linked by the experiences and controversies that came out of the state of Washington and Idaho in the 1970's.[3] The majority of this study is concerned

3. For more information about the ways problems at the Hanford Nuclear Reservation reverberated through the lives of people in Washington see Kate Brown's excellent research on the subject in her book *Plutopia.*

with the ways American understanding of nuclear waste shifted throughout a specific 40-year period and the ways these shifts manifested in Idaho to create a unique analysis of the costs versus the benefits of nuclear technologies and their byproducts (specifically nuclear waste). By the mid 1980's Western states like Nevada, Washington, and Texas no longer shared this analysis. While this study focuses on topics that are firmly set in the context of the American West, the topic has broader implications.

What begins as a somewhat mundane discussion over how to site a state of the art (and potentially dangerous) nuclear research facility and a debate over the health of ranchers and their livestock, quickly moves toward regional concerns over the watershed of the entire Northwestern US, and then begins to branch out internationally. The topic has particular relevance today as the public continues to debate the long-term effects of the Chernobyl disaster in Ukraine, and the Japanese government's continued struggle with the ongoing legacy of the radiation leaked from the reactors at Fukushima. In the wake of catastrophic predictions by a growing number of climate scientists, this low carbon source of energy has received renewed attention as some notable environmentalists who were formerly opposed to nuclear power now make vocal calls for its adoption on a global scale. In order to inform all of these conversations, more work on placing these debates and disasters within a proper historical context is essential. This is one small piece of that larger historiographical project. Although the analysis of nuclear history within a transnational context is of growing importance, this study is primarily situated in a close analysis of the implications of nuclear waste disposal in the context of the American West. Hopefully the research presented here will offer a stepping stone to

further scholarship that will broaden these emerging transnational connections within nuclear historiography.

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BUILDING THE FENCES

On Tuesday, March 22, 1949, a front-page article in the *Idaho Falls Post Register* announced a monumental government project that forever altered the character of the rural East Idaho community. According to the article, the Atomic Energy Commission (AEC) made the final decision over where to site their new National Reactor Testing Station in a meeting three weeks prior.[4] This announcement heralded the dawning of the atomic age in Idaho.

Today, when politicians talk about proposed nuclear sites, it is usually the beginning of intense arguments over the high costs versus the benefits of nuclear technologies. However, In 1949, the conversation included such calculations of costs versus benefits but the results were much different. The AEC and a few other groups laid out several very real dangers associated with developing nuclear technologies in Idaho; instead of internalizing these dangers, Idahoans in local communities focused on developing infrastructure and the economic benefits of a large government project. Only much later did residents of the state express real concerns over the dangers associated with the NRTS.

On first glance, the choice of a site in Eastern Idaho for the new NRTS is puzzling. Up to this point, most nuclear sites in the U.S. were located in areas closer to small cities. The nuclear race started on the campus of the University of Chicago in 1942 when scientists achieved the first artificially sustained nuclear reaction. Shortly after this

4. *Idaho Falls Post Register*, "Arco Area to get West Atomic Plant," March 22, 1949.

event, the federal government established the Argonne National Laboratory as an extension of the University of Chicago. The next year, with the inauguration of the Manhattan Project, the federal government founded three additional national laboratories: the Oak Ridge site in Tennessee, the Los Alamos site in New Mexico, and the Hanford site in Washington. All of these sites were more remote than Argonne but less remote than the site in Idaho, with the exception of the site at Hanford. This begs the question, why would the government choose such a remote site in a state not known for producing scientists let alone nuclear physicists.

In 1949, Idaho had a small population and lots of open land. At that time, only six other states had a population density lower than Idaho.[5] Originally, the AEC considered two sites for the new reactor testing station, the one in Idaho and another one in Fort Peck, Montana. In the end, estimated costs at the Montana site made it less attractive to the AEC.[6] It turns out, low population density and remoteness were important qualities for the AEC, and Idaho possessed both of them.

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5. United States Census Bureau, "Intercensal Estimates of the Total Resident Population of States," (released Feb. 1996), http://www.census.gov/popest/data/state/asrh/1980s/tables/st4049ts.txt. In 1949 the state of Idaho had a population density of approximately 7 people per square mile (psm). The other states with lower population densities that year are as follows: Nevada with a density of 1 person psm, Wyoming with a density of 3 people psm, Montana with a density of 4 people psm, Alaska with a density of 4.5 people psm, New Mexico with a density of 5 people psm, and Arizona with a density of 6 people psm. Coincidentally two of these states (Nevada and New Mexico) received many nuclear projects from the AEC.

6. *Idaho Falls Post Register*, "U.S. Engineer Chief Favors Fort Peck Site," April 14 1949. A Detroit engineering firm (Smith, Hinchman, and Grylls, Inc.) did the report for the AEC that estimated the building and operations costs for each site. According to their report, the estimated construction costs at the Idaho site were 466 million dollars while the cost estimate for the Fort Peck site was 522 million dollars. The projected 66 million dollar cost difference was enough to convince the AEC to pick Idaho.

Almost immediately after the March 22 announcement of the AEC's choice of the Idaho site, Montana's Governor and congressional delegation began a campaign to force the AEC to reconsider Fort Peck. While this group tried a number of different approaches, one of their attempts was particularly interesting. In mid-May 1949, a Montana engineer, G. J. Skibbins, argued to the congressional Atomic Energy Committee that, "…if the atomic energy reactor plant to be built near Arco exploded, it could poison the Snake river 75 years later… it is estimated that atomic poison could seep through the underlying lava beds and reach the river in that time."[7] While a pronouncement like this ought to have given the people living on Idaho's Snake River aquafer pause for concern, there is no evidence that this was the response at the time. There were probably several reasons for this lack of fear. First, the communities in Idaho surrounding the site only wanted to consider the benefits of receiving a large government contract, and for the average person in 1949 the dangers of radiation were relatively unknown.[8] Secondly, Idahoans did not give much credit to the idea because they saw it as a partisan attempt by the state of Montana to steal a lucrative government contract from the state of Idaho. At the time Skibbins made this comment, he was in Washington D.C. lobbying congress on the governor of Montana's behalf. Idahoans clearly could not trust the anti-Idaho rhetoric coming out of Montana. In their eyes, it would have all just seemed like propaganda designed to keep a large government contract out of Idaho. While Idahoans dismissed this

7. *Idaho Falls Post Register*, "Montana Tries New Plant Bid," May 10 1949.

8. For more context on the role of federal money in the development of the Western U.S. see Donald Worster, *Rivers of Empire: Water, Aridity, and the Growth of the American West,* (New York: Oxford University Press, 1985) and Richard White, *"It's Your Misfortune and None of My Own": A New History of the American West*, (Norman: University of Oklahoma Press, 1991).

early warning, it was the first voice that foreshadowed what would later be a monumental shift in the way Idahoans viewed the nuclear program in Idaho.

The biased delegation from Montana was far from the only voice of warning. AEC officials were well aware of the potential dangers surrounding a large nuclear research project. In the event that radiation somehow made it beyond the fences encompassing the site, planners wanted to be sure that any potential contamination to the local population was minimal. At a conference, an AEC official, Sumner T. Pike, put the concerns this way: "There are two major ways that you could have tried to produce atomic power. One is taking it step by step slowly. The other is the way we are doing it where you put your neck way out…We didn't want to put work like this next to a high school… Where it is, this work won't injure *anything of value or tangible assets*, because it is largely on uninhabited lava flow ground."[9] Pike's statement exposes that the AEC was aware early on of the kinds of risks they were taking in trying to quickly develop nuclear power (and the associated technologies). Earlier nuclear labs were also somewhat secluded, although with the exception of Hanford, they were much closer to small cities. AEC officials sited Hanford, like the NRTS, near a small rural community because these officials knew that producing plutonium quickly was extremely dangerous.[10] Although Pike made these pronouncements in a public meeting and they ended up in local Idaho

9. *Idaho Falls Post Register*, "Atomic Plant Danger Seen," April 9, 1949 (emphasis added).

10. Hanford was the plutonium producing part of the Manhattan Project. This part of the process in atomic weapons manufacture was by far the most dangerous in terms of possible radiologic contamination of surrounding populations. Therefore, locating this part of the process in a more remote area made sense as a way of balancing public safety and the need to produce plutonium as quickly as possible.

newspapers, the people who lived around the proposed site appear unconcerned by this information. The proclamation that scientists had selected the site in Idaho specifically as a site that would not hurt "anything of value or tangible assets" was a signal to Idahoans that while the project had calculated risks, the AEC had accounted for, and minimized the danger should anything go wrong. The fact that the project meant a big payday for Eastern Idaho also helped convince local residents. Later, it would become apparent that there was a potential danger to one of Southern Idaho's major tangible assets, but prior to the late 1960s the Idaho public and local government officials did not know or acknowledge such dangers. Thus, for a variety of reasons, people in the state tended to overlook these kinds of potential warnings.

Other articles during this time discussed possible problems the new development would bring. A regional newspaper, *The Deseret News*, reported that many longtime residents were concerned about the "government disturbing the tranquility of the valley" with construction and a disruption of the pastoral landscape.[11] The concern voiced in this article focused more on the effect of industrial development on the landscape than either the potential economic benefits or environmental costs. For these residents, their objections centered on aesthetics. While the *Deseret News* article reflected increasing concerns over growing development in Western states, an article in the April 30, 1949 issue of *Business Week* spoke to a national audience. The largely laudatory article explored the ways the AEC was overcoming past challenges in the American nuclear

11. Genevieve M. Rose, "Idaho Town Gets Set For New Atomic Boom," *Deseret News,* April 3, 1949.

program and would soon continue to propel America toward a glowing nuclear future. The article mentions the NRTS as an example of the types of nuclear progress that was coming.[12] Articles like this helped to excite locals in Idaho and consequently built broader national support for the AEC. However, it was not just positive press like this that convinced Idahoans to trust the AEC early on.

In 1949, Americans had unprecedented trust in their government.[13] The U.S. government had just won World War II and the anxieties of the Cold War had not fully set in. American officials began a pivot away from the wartime horrors of the atomic bombs and towards an emphasis on the peaceful utopian future of atomic research. As a result, the people of Idaho had good reason to place their trust in the AEC. Officials within the AEC projected an aura of experience with balancing the dangers involved in developing nuclear science quickly and the need for communities that could support rapid infrastructure expansion.

Residents of Eastern Idaho communities near the announced NRTS site were also well aware of the importance of the infrastructure to U.S. national interests. In the days following the announcement of the AEC's selection of the Idaho site, a flurry of articles appeared in the *Idaho Falls Post Register*. On March 24th the paper reported that a "mass

12. *Business Week*, "Atomic Energy 1949" April 30, 1949.

13. Pew Research Center, "Public Trust in Government: 1958-2024," (November 13, 2014) www.people-press.org/2014/11/13/public-trust-in-government/. According to this article, the first time Americans were polled about their trust in government was in 1958. In that survey 73% of respondents reported that they trusted government. Conversely, the year the Yucca Mountain waste repository was proposed (1983) only 39% responded that they trusted government. After reaching a high during John F. Kennedy's presidency public trust in government has never polled higher than 54% and that lone peak in trust was immediately following the September 11th 2001 attack on the World Trade Center.

meeting" of residents was held to discuss the "construction of a paved road to the Arco desert, and a fundraising scheme to promote the role of Idaho Falls and vicinity in a development of the new atomic reactor plant."[14] These residents of "Idaho Falls and vicinity" were painfully aware of the great effort required in preparation for the NRTS to open. The newspaper continued to lay out the specifics of these concerns. Aside from the need for a road from Idaho Falls to the nuclear site, articles expressed concerns over space in schools, health facilities, local roads, and housing.[15] Laying the groundwork for a large government facility was going to take a great deal of effort on the part of rural communities in Eastern Idaho. These communities, however, realized that the whole project was going to be a huge boost to an economy that up to this point revolved around small farmers and ranchers: anticipation for the economic benefits of growth ran deep in the community.

This led several communities in Eastern Idaho into competition over who would recieve the AEC's new Idaho Operations Office. Each community came up with a strategy for wooing the AEC in hopes of receiving the majority of the economic benefits from the NRTS. Four communities, Arco, Blackfoot, Pocatello, and Idaho Falls had the best shot of getting the office. Arco's plan was simple; they would play up their location. As the closest community to the proposed site of the NRTS, they felt that they already were the top choice. With the only direct highway that actually connected to the site,

14. *Idaho Falls Post Register*, "City Residents Consider Part In Atom Plant," March 24, 1949.

15. *Idaho Falls Post Register*, "City, County Gird for Atomic Age," March 25, 1949. & *Idaho Falls Post Register*, "E.F. McDermott Heads Atomic Planning Group; Study Sessions Slated," March 27, 1949.

Blackfoot thought they could easily convince the AEC to choose them. Pocatello was the biggest community near the site and planned to use that to their advantage. Unfortunately for Pocatello, it was also the farthest away from the site of the four competing communities. Idaho Falls had no obvious advantages so they came up with an ingenious plan to win support. They called it the "party plan" and it involved selling the cultural aspects of Idaho Falls while at the same time using a bit of clever deception. Leaders in Idaho Falls hosted a series of parties for visiting AEC officials involving local clubs and civic organizations. In essence, they wined and dined the AEC dignitaries. They also deceived those officials by claiming that a road out to the site was currently under construction. They went so far as to begin work on a small section of the proposed road to show to AEC officials. Although the funds to build the actual road did not exist at the time, leaders hoped they would be able to convince the state to help fund the development of a road out to the site if the AEC chose to locate its Idaho offices in Idaho Falls. The ruse paid off and the AEC chose Idaho Falls to host their local operations office.[16]

While many in the local communities anxiously awaited the inpouring of federal dollars, some did not see the development of the site purely in terms of economic benefit. For local ranchers, the picture was more complex. The proposed site of the National Reactor Testing Station was huge, and while grazing did not take place on all of that land, the grazing land situated on the site represented about 10% of the grazing land within the

16. Susan M. Stacy, *Proving the Principle: A History of The Idaho Engineering and Environmental Laboratory 1949-1999*, (Idaho Falls: Idaho Operations Office of the Department of Energy, 2000), Ch. 4.

county. The AEC was aware of these concerns and attempted to reduce the impact on cattle ranchers. They vowed to allow the ranchers to continue exercising their grazing rights for at least a year but they recognized that at some point in the near future elimination of these rights would occur. While this was significant, the acting District Grazer assured AEC officials that this land withdrawal would not represent a significant burden for local ranchers.[17] Local ranchers did make do with the land left in the grazing district and seem not to have complained much about the loss of land at the time. They also do not seem to have expressed any concerns over possible radiation exposure to cattle grazing near the new site prior to the completion of the first reactor at the site two years later. As the AEC's operations in Idaho began to expand, ranchers would begin to express concerns that were tied to the health of their cattle and families.

In the end, construction on the site started without much fanfare. It is apparent that at least some people in Idaho knew about possible problems surrounding a large nuclear research site. In the face of such knowledge, Idahoans voiced none of these possible concerns. An optimistic attitude pervades this early period of the nuclear project in Idaho. Rural Idahoans trusted the government to protect them and their interests. Idahoans who lived farther away looked forward to the broader economic benefits of growth in the state and the prestige of having a large nuclear science project within the state. They made a kind of cost benefit analysis that emphasized the economic and intellectual benefits of large government research projects while at the same time minimizing the potential costs associated with industrial sites. This type of thinking

17. *Idaho Falls Post Register*, "Atom Grazing Problem Eyed," April 25, 1949.

would continue to dominate in Idaho until people encountered facts that forced them to rethink their analysis of costs versus benefits.

18

BEHIND THE FENCES

> The handling and disposal of radioactive wastes is a general problem the thread of which runs through the complete fabric of peaceful nuclear energy operation. In the peacetime, day-to-day application of the benefits of nuclear energy the disposal of wastes potentially represents the major "nonbeneficial" effect on the public and its resources.
>
> -Dr. Joseph A. Lieberman, Sanitary Engineer[18]

As Uranium-235 began to fission in reactor cores at the NRTS, Idahoans were oblivious to the problems associated with the waste those reactors produced and the solutions to nuclear waste disposal that nuclear engineers internally, without community input, developed to tackle these problems. What began at the NRTS in a somewhat makeshift way would later grow in complexity and sophistication as nuclear science matured and the broader public's understanding about this type of waste grew. Early on, nuclear scientists understood that producing nuclear technologies was an industrial process, and as such, would produce waste on an industrial scale. The waste stream initially posed few problems as AEC contractors were largely able to dispose of wastes as they saw fit. As wastes grew over time, and the public at large became more aware of government nuclear waste disposal projects and the potential dangers associated with them, the NRTS found itself increasingly constrained by shifting public perceptions within the state of Idaho. This public pressure (leading to political pressure) created the impetus for the AEC to rethink its waste disposal procedures in Idaho.

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18. Joseph A. Leiberman, "Engineering Aspects of the Disposal of Radioactive Wastes from the Peacetime Applications of Nuclear Technology," *American Journal of Public Health and the Nation's Health* 47, no. 3 (March 1957) 345.

To understand what occurred with nuclear waste in Idaho, it is important to know a little about the nature of nuclear waste. The NRTS has produced four types of nuclear waste from its inception to the present. The first of these wastes, called "mixed waste," consists of a mixture of hazardous industrial wastes and material contaminated with radiation. This waste is difficult to dispose of safely due to its dual nature (meaning that it has chemicals that are dangerous in their own right but also has the added danger of radiological contamination). The next type of waste produced by the NRTS is called "low-level radioactive waste." This waste is mostly made of radioactive waste that is either not concentrated enough to pose as great a risk as other radioactive wastes, or consists of relatively short-lived radionuclides. For these reasons, safe disposal of low-level waste is less complex than disposal of higher-level wastes. The third type of waste is classified as "high-level wastes." These wastes are highly radioactive and are typically derived as a byproduct of processing spent nuclear fuels. This waste remains radioactive on long timescales and must be totally isolated from the environment to avoid permanent damage. According to an article in *The Idaho Statesman*, "If a man stood next to [high-level] waste for an hour without shielding he would die."[19] This type of waste therefore represents a serious danger to living organisms and thus presents great challenges for safe disposal and environmental isolation. The final waste type is "transuranic waste" (sometimes abbreviated as TRU waste). Transuranic waste contains radionuclides with an atomic weight greater than uranium, half-lives of greater than 20 years, and that emit alpha radiation. All of these wastes require delicate handling and are dangerous and

19. *Idaho Statesman,* "Nation Awaits Decision on N-Wastes in Idaho," June 3, 1979.

potentially deadly if prolonged exposure occurs. One of the major concerns surrounding disposal of all types of radioactive isotopes comes in the ability of these isotopes to bio-accumulate. What starts as un-concentrated, low level waste, can bio-accumulate in plants and animals becoming far more dangerous than the original waste. Due to these very serious dangers associated with nuclear projects, the process and history of waste disposal is a vital topic when seeking to understand the impact NRTS has had on the way people in Idaho understand nuclear issues and associated environmental costs.[20]

At the time construction began on the first reactor at the NRTS in 1949, the AEC had no set standards for the disposal of nuclear waste. Instead, the AEC allowed each of its laboratories to figure out individually how best to dispose of its contaminated waste. The solution in Idaho (at least as far as solid waste was concerned) was to bury it. In May 1952, the NRTS Burial Ground was born. Here, sequestered behind fences and far from the prying eyes of the public, nuclear waste first entered the desert soils of Idaho. Initially the landfill was made of crude unlined trenches into which NRTS employees threw waste haphazardly. It was a common occurrence for engineers to discard waste packaged in cardboard boxes or sealed in steel drums, with little else to separate it from the environment. A report on waste management at the site from 1977 described early disposal practices this way: “From 1954 through 1970, transuranic contaminated wastes were buried in large pits and covered with two feet or more of earth. Some 2.3 million cubic feet of waste are buried in the ground… Regular analysis of groundwater shows

20. U.S. Department of Energy, *Environmental Restoration and Waste Management*, prepared by the Idaho National Engineering Laboratory, Idaho Falls: Idaho Operations Office, 1991.

that no radioactive materials from the solid storage area have reached the aquifer…"[21] It is important to note that the AEC does not dispute the nature of its burial practices, only that such practices ever posed a real threat to the environment. These early waste disposal practices represent the type of techno-scientific hubris common in the AEC at this time. The scientists running the AEC believed they had the power create boundaries for and then fully control radioactive particles. For these scientists a few feet of soil was more than enough to eliminate the radioactive threat of radioactive waste products. What these scientists and engineers failed to fully understand are all of the complex ways radioisotopes move throughout the environment.[22]

Once a waste trench was full, employees covered it with dirt and planted it with native grasses. With new trenches dug every one to two years, trenches began to proliferate at the burial ground. By 1957, 13 acres of buried nuclear garbage filled the original plot set aside for waste disposal and the NRTS greatly expanded the size of the burial ground.[23] As mentioned at the outset of this study, this burial ground is one of the enduring legacies of the Idaho National Laboratory. These burial practices and the ways the AEC and NRTS employees managed information surrounding the process of waste disposal played a big part in the later reactions of Idahoans. More broadly, the public

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21. Energy Research and Development Administration, *Waste Management Information: Idaho National Engineering Laboratory*, Idaho Falls: Idaho Operations Office, 1977.

22. E. Jerry Jessee has done excellent work revealing the ways the AEC and the US military were deeply entrenched in this way of thinking during the late 1940s and throughout the 1950s in his dissertation "Radiation Ecologies." Jacob Darwin Hamblin also shows this type of thinking throughout America's Cold War science/industrial military complex in his book *Arming Mother Nature.*

23. Stacey, *Proving the Principle*, 74-81.

perceptions that formed in regards to governmental oversight of nuclear waste became a big factor in American's shift from support of nuclear projects in the 1950s to opposition by the 1980s.

By 1960, the buildup of waste at the NRTS began to raise concerns among certain citizens and scientists, but not for the reasons one might assume. These early voices of concern were not primarily worried with the environmental or health risks of such mounting waste, but that problems associated with the disposal of waste created a bottleneck that slowed the development of nuclear power and in turn, the economic prosperity tied to nuclear research. At this time, nuclear scientists were still optimistic about the future of nuclear power. In response to these fears the AEC's chief sanitary engineer, Dr. Joseph A. Lieberman explained, "We see no reason why waste disposal will become any limiting factor… there have been decisive strides in meeting the problem."[24] While Lieberman acknowledged that a buildup of nuclear waste was indeed a problem that faced the AEC, he minimized that problem by emphasizing the progress the AEC had already made in reducing such wastes and the hope that future techno-science fixes would further reduce or eliminate the problem. While Lieberman may not have represented the view of each individual scientist working for the AEC at that time, it is safe to conclude that he represented the official view of the AEC on the matter of waste disposal. In other words, in 1960 the AEC did not see nuclear waste as a limiting factor and expected to overcome any challenges the waste stream posed without problems.

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24. *Idaho Statesman*, "Official Says Atom Waste Won't Slow Energy Effort," September 30, 1960.

Such statements are important because they provide a framework for understanding how the AEC approached waste disposal at the NRTS. It is also important to look at what the AEC outlined as its enumerated objectives in its waste management program around this time. In the same 1977 report cited above, what was by that point called the Idaho National Engineering Laboratory (formerly the NRTS) expressed its objectives in this manner,

> INEL and its contractors are required to conduct their operations and dispose of and store radioactive waste in such a manner as to assure that present and future radiation exposures to individuals and population groups will be at the lowest levels technically and economically practical, not exceeding limits established in the [Energy Research and Development Administration] ERDA standards for radiation protection. Some of the main waste management objectives at the INEL are:
>
> Protect the health and safety of employees and the public
> Protect man's environment
> Contain high-level radioactive waste
> Solidify liquid high-level waste to safer, immobile form[25]

While this shows that the AEC's operations in Idaho aimed to minimize radiation exposure to the public and environment, this quote also voiced two qualifications: the AEC would do this as long as it was technically and economically practical. The report does not go on to clarify what the AEC defined as being technically and economically practical and what waste disposal measures may have been better for keeping waste isolated from people and the environment but were not seen by administrators as technically or economically feasible. While this statement helps to clarify what the AEC thought its role was in ensuring the isolation of hazardous radioactive wastes it is also

25. Energy Research and Development Administration, *Waste Management Information: Idaho National Engineering Laboratory.*

important to recognize that the AEC also had limitations when it came to what they were willing to do to fulfill this role.

It is best to think of these limitations as a reflection of the position that the nuclear scientists working in Idaho had when it came to the disposal of nuclear waste. Concerning such a position *The Idaho Statesman* reported in 1970 that, "The AEC personnel [at the NRTS]… repeatedly stated that the burial sites offer no health hazards. They based their contention on three factors: (1) materials buried are not subject to being dissolved… (2) very little moisture occurs in the form of precipitation at that particular burial place and (3) approximately 600 feet of soil and rock… lies beneath the surface of the ground and the so-called Snake River Plain aquifer."[26] While early waste disposal took place in unlined trenches that by modern nuclear disposal standards seems unthinkable, this quote makes it clear that nuclear scientists felt they had good reasons for their confidence that even this crude type of burial posed no real threat for radiological took place in unlined trenches that by modern nuclear disposal standards seems unthinkable, this quote makes it clear that nuclear scientists felt they had good reasons for their confidence that even this crude type of burial posed no real threat for radiological contamination (see figure 1). Due to the arid conditions in Idaho and the presence of a large layer of lava rock between the burial site and the aquifer, scientists felt that they needed few additional protections to ensure that the waste they were burying remained isolated from the broader environment.

26. *Idaho Statesman*, "Gem Health Aides Hear AEC Officers Contend Safety of Disposal Methods," January 21, 1970.

Figure 1: Low-level waste burial at NRTS in 1958

While the facts that the scientists gave about the amount of precipitation and the conditions of the surrounding geology are accurate, what these facts hide is that, given the right environmental and climatological conditions, the burial site was prone to flooding. Two photographs from the NRTS Burial Grounds taken in the 1960s illustrate what happened when this type of flooding occurred.

While the scientists implied that due to low rates of annual precipitation, nuclear wastes at the NRTS would be largely isolated from contact with water, figures 2 and 3

clearly show that was not the case and that the assertion of the scientists was at least somewhat misleading. While flooding is not common in this area of the Western U.S. it can occur given the right conditions. These conditions typically include large snowstorms followed by warmer weather and rain. This essentially doubles the amount of precipitation that is typical for any single storm and can lead to this kind of flooding event. The use of heavy machinery in excavating the trenches likely caused soil compaction and altered the ability of the soil to absorb precipitation. At the time, the public would not have known that waste at the site had in fact been in contact with water that at some point would end up in the Snake River Plain Aquifer. The AEC scientists had overestimated their ability to rationalize and control the unpredictability inherent in nature; floating barrels of nuclear waste was the unfortunate result.

By the late 1960s, and throughout the 1970s, knowledge about the AEC's waste disposal programs became more public and as a result, the ways the NRTS disposed of its waste changed. AEC officials continued to insist on the safety of earlier disposal methods while at the same time adding many new measures to increase the isolation of this waste from the environment. Some of the changes were due to the need to make waste more transportable as the AEC developed plans for the eventual construction of permanent waste repositories. Other changes came as a way to extend the life of the containers used to isolate the waste itself. By 1971, high-level waste at the site was being disposed of in stainless steel bins inside underground concrete vaults with thick walls. The way transuranic waste was disposed of had perhaps changed the most. In contrast to the earlier

Figure 2: NRTS flooded pit, February 1962

Figure 3: NRTS flooded pit no. 9, January 1969

practice of burying these wastes in unlined trenches, "In 1970, a new policy required separate and retrievable storage of all transuranic waste. From this point on, transuranic waste was sent to the Transuranic Storage Area [TSA] adjacent to the burial grounds… Waste was now compacted prior to disposal and standard packaging criteria were established."[27] This meant that putting nuclear waste in cardboard boxes and then burying it in an unlined trench, as was the practice in the 1950s, was no longer an acceptible option (figure 4 illustrates these changes). The disposal of waste in lined barrels, stacked neatly, and covered with plywood and plastic represented the new norm. At this same time, low-level radioactive liquid wastes and certain chemicals were being disposed by pumping the waste through a well and into the aquifer. The AEC contended that such low-level wastes in the aquifer diluted and test wells on the site showed that concentrations of radioisotopes and harmful chemicals were well within established standards for drinking water. Due to this fact, Dr. C.W. Bills from the AEC's Idaho operations office told reporters that, "in this context we are confident that the small amount of radioactivity diluted by the large volume of nonradioactive water pumped back into the aquifer is not detrimental to the quality of the Snake plain aquifer."[28] Again, the scientific leadership at the NRTS continued to believe that their waste disposal practices had improved over time and that the safety of older disposal methods was well

27. Idaho Department of Environmental Quality, *State of Idaho Oversight Monitor: November 2006*, (Boise, 2006.), 10-11, https://www.deq.idaho.gov/media/552764-newsletter_1106.pdf.

28. *Idaho Statesman*, "AEC Claims Atomic Wastes No Threat to Gem Aquifer," October 21, 1971.

Figure 4: INEL waste at the TSA, 1971

established. While the AEC's scientists continued to insist that established waste disposal practices represented no threat to the environment, the Idaho public did not remain as convinced of that fact as it was initially.

Understanding why the public was so oblivious to the potential problems with early nuclear waste disposal at the NRTS has to do with the fact that scientific understanding and public opinion had not yet collided in such a way that people would

even think to question the AEC. However, another key factor played a part: the secrecy of the AEC regarding their operations in Idaho. Historian Jack M. Holl has convincingly argued that one of the AEC's main objectives in building the NRTS in Idaho was to "significantly [strengthen] the presence of the federal government in southeastern Idaho at the same time that it established its own unquestionable authority in all matters pertaining to the operation of the [NRTS]... the AEC tolerated no interference from state and local authorities..."[29] The AEC quickly established in Idaho a relationship of secrecy and supremacy where the agency dictated its needs to the state, but where the state had no regulatory or oversight capacity. The people of Idaho did not question this relationship in the 1950s as the AEC established the NRTS. The AEC had been empowered by the Atomic Energy Act passed by Congress in 1946. As established earlier, the state of Idaho and people who lived there trusted that the federal programs at the NRTS would bring only prosperity, as the promises of the nuclear age found fulfillment in the Idaho desert. This early calculation of nuclear benefits without costs remained dominant until the 1960s when popular fears about nuclear radiation began building, eventually reaching a critical mass in the 1970s. Information about what happened behind the fences at the NRTS made its way to the public in Idaho and forced them to wrestle with the realities of the nuclear program, often in unsettling ways.

Burying nuclear waste in cardboard boxes may have seemed reasonable in the 1950s, but after the eruption of popular knowledge regarding nuclear waste in the 1960s coinciding with the rise of the broader environmental movement, such practices were no

29. Jack M. Holl, "The National Reactor Testing Station: The Atomic Energy Commission in Idaho, 1949-1962," *Pacific Northwest Quarterly* 85 no 1 (January 1994) 15.

longer tenable. As the Idaho public became more aware of waste disposal at the NRTS, waste disposal practices began to change. This was largely because as people in Idaho learned more about what was actually occurring in terms of waste disposal they began to reevaluate the costs in relation to the benefits of the AEC's operations in the state and called for changes. Information came slowly and objections from the Idaho public came in many forms although very few were totally opposed to the AEC's continued operations within the state. For the broader American public the cost benefit calculations would shift even further until large-scale government sponsored nuclear programs had few supporters.

BEYOND THE FENCES

It took Idahoans nearly a decade before hints that the economic calculus behind their initial decision to welcome the AEC into Idaho was beginning to change. Idahoans either had been ignorant of or downplayed the serious problems associated with a large nuclear research station. Of particular significance was the fact that no one seemed to consider nuclear waste disposal and what that meant for the environment of Idaho and the state's natural resources.[30] Whether or not they wanted to, the people of Idaho could not continue to be ignorant of the mounting nuclear waste in their state. As Idahoans increasingly confronted information about what was happening at the NRTS, they began to rethink their earlier analysis of the benefits of the nuclear project in the state. This ultimately led to more questions from journalists and the public, but these questions did not begin all at once. Rather, they began as a trickle that eventually gained strength and momentum. These questions began early on and foreshadowed a shifting tide of sentiment that few could have predicted in 1949.

One of the early instances of a national periodical questioning the AEC was contained in the April 1955 issue of *Popular Mechanics.* The magazine featured an article that discussed some of the dangers of radioactive waste in an article titled "The World's Hottest Garbage". This article, on the one hand, offered a critical assessment of

30. While there is little evidence to suggest that the Idaho public or Idaho's elected officials raised questions about waste disposal early on there is some evidence to suggest this was on the minds of officials at the AEC. The major cause for this thinking is the fact that the Hanford site, which housed reactors used for plutonium production, was located in an area that had very similar environmental and geologic features. The similarities between these two sites were not coincidental. For more information on the reasons the Hanford site was chosen see Kate Brown, *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters,* (New York: Oxford University Press, 2013).

the nation's growing nuclear waste stating, "...that none of the present or proposed means of disposal-- from water or air dispersal to desert burial – can offer a completely satisfactory solution for the tons of radioactive waste the world will be piling up in about A.D. 2000."[31] On the other hand, after discussing the atomic waste storage capacity of the Hanford Atomic Works the article makes this problematic statement, "...The 384,000-acre Hanford reservation has a unique soil situation which permits some waste from plutonium plants to be run off into discharge pits instead of storage tanks. The desert soil soaks up the deadly wastes with sponge-like rapidity, and earth particles trap and filter much of the radioactive material on its way down."[32] Statements such as this represented an optimistic viewpoint that the natural desert soils alone, without any other precautions, would isolate radioactive materials from the broader environment for hundreds or thousands of years. In her recent study in the book *Plutopia*, historian Kate Brown has provided a great deal of evidence that the AEC made huge miscalculations in their waste management programs at Hanford. Leaking storage tanks leached radioactive liquids first into these desert soils and then into the Columbia River. In such instances, the desert soil did little to help. Such overly optimistic views were common in this period when nuclear physicists, doctors, and ecologists were still studying radioactive materials and many questions were still unanswered about the biological and environmental impacts of these materials.[33] The rest of the article makes clear just how little Hanford scientists knew at

31. Rafe Gibbs, "The Worlds Hottest Garbage," *Popular Mechanics,* April 1955, 124.

32. *Ibid.*, 124-125.

33. Section 2 discussed at length the ways people in the 1940s and 50s trusted government and focused on the benefits while minimizing the costs of federal projects. See also (continued on next page)

this time about radiation exposure and how best to isolate waste from the environment. The article ends with a rather uncritical statement of, “so far so good” in response to the AEC's waste disposal program. The absence of public knowledge about problems with waste disposal made it easy for journalists during this period to either write with this kind of supportive tone towards the American nuclear project or at best, offer an ambiguous take on the topic as this article does. It also provides us with a context for the way Americans were viewing government nuclear projects at this time. There was some acknowledgement that the wastes produced by the government’s nuclear projects were problematic but when the nation had miraculous “desert soil[s] soak[ing] up the deadly wastes” there was little to worry about. Reports like these made it easy for people to ignore the possibility of problems.

In Idaho, it took close to two decades before large groups of citizens began to question what was taking place at the NRTS. While it took time for public opinion to make sweeping changes, the roots of this opposition occurred much earlier. By 1957, a group of local ranchers began to have some major issues with the AEC’s decisions regarding the NRTS. Early that year, the AEC announced plans to expand the area encompassed by the NRTS by an additional 182,000 acres. Not surprisingly, local ranchers had a number of concerns about this expansion. Louie D. Laird, one of these ranchers, expressed a major concern in a letter to one of Idaho’s senators, Frank Church. “From the newspaper accounts it appears that the necessity of annexing this additional

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Emory Jerry Jessee, “Radiation Ecologies: Bombs, Bodies, and Environment During the Atmospheric Nuclear Weapons Testing Period, 1942-1965.”

land arises from the danger to the livestock grazing in the area," he explained. "If it is going to be dangerous to the livestock, then those of us who live a very short distance further from the actual operations wonder about our safety."[34] While this rancher represents Idahoans in a period where they were still unaware of the problems with nuclear waste at the NRTS, the important thing about this quote is the expression of the idea that activities of the AEC in Idaho might be dangerous to local residents. Ranchers were looking to their livestock as an indicator of whether or not it was safe for humans to be near a nuclear facility. Anything that raised concerns over the safety of cattle similarly raised concerns in ranchers' minds about the safety of the broader public.[35] This is one of the first instances where a group of Idaho residents expressed this type of concern about the health and safety of people living near the AEC's operations in Idaho. Such concerns are important because they illustrate how one narrow group within the state began to re-evaluate the earlier cost-benefit calculation. Another letter from a different rancher expressed a similar concern in this way,

> From the standpoint of the safety of the people who have lived in the section of Monteview, Terreton, Mud Lake, Hamer, and Dubois for generations; we feel that if the operations are extended, it should be away from the homes of these good people. Distance is the best protection they have from the radiation trash which may contaminate the atmosphere in the vicinity of that reactor station… These people have already made great sacrifice in having their lives being shortened by radiation and we beg of you to reconsider their welfare and that the operations in that local not be increased.[36]

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34. Louie D. Laird to Senator Frank Church, March 28, 1957, Frank Church Papers, Boise State University Library, Boise, ID.

35. In his book *Mass Destruction* Timothy J. LeCain goes into greater detail on some of the ways Western ranchers and farmers used local knowledge of plants and animals as a key environmental indicator and as a way to protect community health.

36. Caton W. Pierce to The Bureau of Land Management, March 22, 1957, Frank Church Papers, Boise State University Library, Boise, ID.

This quote differs because it specifically mentions “radiation trash” and the idea that the people who live near the site understood that they were exposed to a level of radiation and that this exposure was shortening their lives. According to the quote this was a “sacrifice” the people knowingly agreed to make. While the author of the letter says the phrase “radiation trash” it is clear in the context of the quote and broader letter that he was not referring to the area known as the NRTS Burial Ground and the possible radioactive contamination from waste disposal. Instead, the context suggests that this statement refers to releases of radioactive gasses into the atmosphere and the subsequent exposure of residents downwind of these radioactive gasses. The second part of the statement is more important, though. It alludes to the idea that the people in Eastern Idaho knew early on that there were dangers associated with living in proximity to a nuclear site and made a kind of social contract with the AEC that allowed for nuclear research and in the process exposure of the local population to a certain amount of unnatural radiation. One of the things that made the idea of the AEC expanding the size of its operations in Idaho so upsetting to the rancher in this letter was the fact that to him this expansion represented a change in this prior agreement without the consent of the citizens. In other words, residents understood there was a certain amount of risk of ill health effects that came with living in proximity to a nuclear site; they had made the decision that these risks were an acceptable “sacrifice” within their calculation of the costs versus the benefits. When that proposition changed and residents perceived the threat of greater exposure, the cost-benefit calculation changed and they made their opposition known. Perhaps it is no surprise that the ranchers were the first to voice

opposition. During the initial construction of the NRTS, ranchers lost a significant amount of rangeland and thus paid the highest costs and had probably seen few benefits. Now the AEC asked them to bear even greater costs without any associated increase in potential benefits. For these ranchers their ties to the local environment made the cost versus the benefits of living next to a nuclear facility particularly one sided.[37]

This opposition from ranchers living near the edge of the NRTS in 1957 illustrates an early foundation and model for nuclear opposition that continued to grow in Idaho over the next several decades. Citizens of Idaho were certainly concerned with protecting their health and safety but they primarily talked about these issues in terms that related to this kind of calculation of the costs versus the benefits of the nuclear project. This is apparent in the objections raised by this small group of ranchers. These same concerns would continue to resonate in Idaho. Part of the reason opposition was such a gradual and complicated process in Idaho had to do with the competing interest in economic prosperity and protecting Idaho's natural resources. In March 1967, these competing interests manifested themselves when the lieutenant governor, Jack M. Murphy signed a law on behalf of the governor that created the Idaho State Nuclear Energy Commission. The lieutenant governor stated that,

> "the aim of the commission is to encourage the industrial and economic growth of the state to the maximum extent consistent with the health and safety of the public… to encourage widespread participation in the development and utilization of peaceful uses of nuclear energy and to institute and maintain a regulatory program for sources of ionizing radiation so as to provide for compatibility with standards and regulatory programs

37. Perhaps one of the more interesting lessons from these quotes is that while Western farmers and ranchers are not often thought of as environmentalists, their close ties to the health of the land leads this group into a particular kind of environmental advocacy.

> of the federal government. Also, to create a single effective system of regulation within the state…"[38]

This statement points to the fact that officials within Idaho wanted to create a state regulatory agency to deal with nuclear issues but that this agency's primary mission was to encourage growth in the nuclear industry in Idaho and thus maximize the economic benefits. The competing interest comes in the fact that this growth was to be qualified by the responsibility to protect the public. Nothing in these statements indicates that people in Idaho were yet thinking about the health of the broader environment outside of the concern for the health and welfare of the Idaho public. The context for these concerns came in the form of economic costs. Environmental concern however, would soon manifest itself.

Just two years after the formation of the State Nuclear Energy Commission, an Idaho businessman, Robert A. Erkins, began to raise big concerns about the types of waste disposal going on at the NRTS. Of main concern to Erkins was the possibility that waste from the NRTS was contaminating the Snake River Plain Aquifer. In a letter to the governor of Idaho Erkins suggested that, "a 'national dump' be found where there would be no drainage into resources such as the Snake River Plain Aquifer. 'Certainly now is the time to call for a national dump where the waste materials of our civilization, such as this radioactive material, can be stored… I have come to the conclusion that there is a great deal of concern among the people of the state of Idaho about the area that is used for the disposal."[39] This statement by Erkins is important for a few reasons. This

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38. *Idaho Statesman*, "Murphy Signs Bill Creating 'A' Panel," March 18, 1967.

39. *Idaho Statesman*, "Idahoan Urges National Dump for Nuclear Waste," October 1, 1969.

statement was one of the first pointing out the potential dangers of storing waste over one of the nation's largest aquifers.[40] Should radiation somehow contaminate the aquifer the effects could be devastating to one of Idaho's most economically important natural resources.[41] While the nuclear scientists at the NRTS did not think this was an issue, Erkins points to the fact that by this time many Idahoans were becoming concerned and viewed the storage of nuclear waste above the aquifer as problematic.

The social context of this period is also important. Americans were in the middle of some very important societal shifts at the end of the 1960s. First, the public trust in government was in the middle of a long downward trend that would not bottom out until about 1980. This trend shows that Americans were feeling less optimistic about what their government was doing during this period and as a result were more likely to question the decisions made by government.[42] This lack of trust in government had an effect on the way Idahoans viewed the potential costs of nuclear waste in the state. The year 1969 was also the middle of the Cold War and the most iconic theater of that conflict, the Vietnam War. For American society, the Vietnam War represented a time of unprecedented social division and conflict. Many Americans openly demonstrated against

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40. The Snake River Plain Aquifer is vital to Idaho's economy. Farmers used water from the aquifer in a network of canals and wells to irrigate over 3 million acres of farmland. Geologists divide the aquifer into eastern and western parts. The larger eastern part of the aquifer covers an area of roughly 28,000 square kilometers (or 17,398 square miles). For more information on the geology of the aquifer, see http://geology.isu.edu/Digital_Geology_Idaho/Module15/mod15.htm.

41. For a deeper look at the history of irrigation on the Snake River Plain and the importance of irrigation for this region, see Mark Fiege's book, *Irrigated Eden: The Making of an Agricultural Landscape in the American West*.

42. Pew Research Center, "Public Trust in Government: 1958-2024", (November 13, 2014) www.people-press.org/2014/11/13/public-trust-in-government/.

the war and the government that had initiated it. It was against this backdrop that concerns over the NRTS's actions, and their effect on the environment, began to surface in Idaho.

This growing concern in 1969 about what was happening at the NRTS was not limited to Idaho's citizens alone. Late in the year, officials from the state of Idaho began an attempt to force the AEC to change the way it was operating in the state. *The Idaho Statesman* reported that "The State Health Board agreed today to ask the Atomic Energy Commission to stop burying nuclear wastes in the desert near its Eastern Idaho National Reactor Testing Station… they voted to urge the AEC to plan and implement the ending of disposal of liquid and solid wastes by means other than underground disposal practices. Despite AEC contentions the current practice has not caused any environmental damage, there has been considerable criticism of the practice."[43] This suggests that the public and the state were becoming less trusting of the official statements coming from the AEC and the NRTS and that state agencies were responding to the increasing concerns of constituents. The wording of the article does give a glimpse into the power dynamic between the state and the AEC at this time. Rather than demanding, or forcing the AEC to stop disposing of its waste on site, the State Health Board instead asked them to do it. This wording suggests that the state did not feel it was on equal footing with the AEC and could not make demands of the agency; instead, they could only make a request the AEC could easily deny.

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43. *Idaho Statesman,* "Health Board Will Ask AEC To Stop Burying Its Waste," November 15, 1969.

Two months after the request to remove the waste by the State Health Board, the AEC sent a team of scientists to meet with officials from that agency in order to convince them that their waste disposal practices were sound and were not having an impact on the environment. After hearing eight hours of technical information about the waste disposal operations at the NRTS and taking a tour of the waste burial site, apparently the AEC had convinced state health officials that what they were doing was safe. The administrator of the Idaho Department of Health, Dr. Terrell O. Carver said after the meeting, "there is no question but what the AEC people believe with all sincerity what they are doing in terms of disposing of solid waste at the burial sites is a safe operation… This certainly seems to me a step in the right direction."[44] Dr. Carver's statement shows that the meeting had the effect the AEC wanted. They were thus able to avoid (for the time being) further pressure from the state to stop its waste disposal programs. Although the AEC won a battle, they saw the warning signs of a coming war: they would no longer be able to do exactly what they wanted with their waste disposal program in Idaho. As a result, in June the AEC announced plans to move waste to a yet to be determined permanent nuclear waste repository. The AEC claimed that such a repository would be in operation by 1980 and that waste in Idaho could then begin to leave the site for this permanent storage facility.[45]

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44. *Idaho Statesman,* "Gem Health Aides Hear AEC Officers Contend Safety of Disposal Methods," January 21, 1970.

45. *Idaho Statesman,* "Removal of Idaho Atomic Wastes Eyed," June 2, 1970. Unfortunately, the AEC was not able to meet the timetable it had set for opening a permanent nuclear waste repository. The Waste Isolation Pilot Plant did not open until 1999, almost two decades later than the AEC's original 1980 projection. At the time, this paper was written (2016) the Yucca Mountain waste repository in Nevada had yet to open and barring some unforeseen changes looks like it will never open.

In the midst of debates over the negative aspects of nuclear waste disposal in Idaho, some residents of the state held fast to the earlier view of the NRTS as only benefitting the state. Due to this fact, some expressed their continuing support for the waste disposal project in Idaho. One constituent felt strongly enough about this issue that he wrote a letter to Senator Frank Church expressing his views. The author of this letter, F. W. Dykes stated,

> I am not in a position to know what the percentage is, but some of the waste buried is so slightly contaminated that it would cause less harm floating down the Snake River than the refuse from the potato processing plants and the city sewage systems. To require that such waste be dug up and… shipped out of state is an unnecessary burden to the NRTS… I believe, Senator Church, that 'encumbent upon' and 'demands' are pretty strong words to use based on the 'feelings' of this obviously incompetent government or quasi-government body.[46]

Of Dykes' several concerns, the first was for the NRTS itself. The removal of waste would cost a significant amount of money, take time and manpower, and created an unnecessary logistical challenge. Dykes felt this represented a burden to the NRTS in the form of unnecessary expenditures of resources and an eventual loss of jobs as a major area of operations at the NRTS closed its doors. The second part of this quote expresses a kind of distrust of government. Rather than being distrustful of the AEC in Idaho, Dykes trusted the federal government that was located locally and providing economic benefits. He did not, however, trust the federal agency that was distant and which he perceived as hurting the local community. The first reason for supporting the NRTS had close ties to the reasons why people originally supported building the NRTS in Idaho in the first

46. F. W. Dykes to Senator Frank Church, June 23, 1970, Frank Church Papers, Boise State University Library, Boise, ID.

place. People in in Eastern Idaho were still very reliant on outside federal dollars to support continued growth in the area. This economic impact was a strong motivator for building a coalition of local AEC support in Eastern Idaho. The second reason deals with proximity. It is much easier to ignore the possible harm caused by local federal administrator when they bring economic benefits to the local community than to support federal administrators located in the Eastern U.S. who did not understand the local community or the local ramifications of their actions. For this reason, people like Dykes felt the need to defend the operations of the AEC in Idaho.

Some unlikely allies of the NRTS and the AEC also emerged in Idaho during this time. An Idaho based environmental group, the Idaho Environmental Council, took it upon themselves to correct some articles that were very critical of the nuclear power industry and nuclear research. P. B. Henault, the director of the Idaho Environmental Council, wrote letters to the editors of *LOOK Magazine* and *Conservation News*. During this time, many in the environmental movement were coalescing around an opposition to all things nuclear (weapons testing, reactor research, and waste disposal practices). This oppositional stance to the nuclear industry remained strongly tied to environmentalism through the 1990s.[47] What makes P. B. Henault's letters so interesting is the fact the he outlines a position that is almost identical to the ones pro-nuclear environmentalists are making today in light of the debates surrounding anthropogenic climate change. The position Henault outlines is this,

47. Rens Van Munster and Casper Sylvest, "Pro-Nuclear Environmentalism: Should We Learn to Stop Worrying and Love Nuclear Energy?" *Technology and Culture* 56, no. 4 (October 2015): 789-807.

> I think we conservationists have to recognize that the Nation's power needs, no matter what we do, are going to skyrocket in the next few years… A large coal-fired power plant of 350,000 kW emits about 75 tons of sulphur dioxide, 16 tons of nitrogen oxide, and 5 tons of ash particles each day… We know that nuclear power is an alternative to these environmentally-devastating, traditional methods. Nuclear plants, some providing three times as much power as the above examples, are being operated with no obvious harmful effects to our environment.[48]

While Henault's argument is not exactly the same as current pro-nuclear environmentalists, it does share some interesting points. Henault's main point is that traditional coal-fired power generation in the 1970s was a major source of air pollution that contributed to environmental problems at the time, like acid rain and smog. With energy demand on a steep upward climb in the 1970s, the nuclear solution had emerged as the best option for maintaining a healthy environment. This quote suggests that nuclear power generation has no negative environmental costs and Henault thus argues that nuclear power be taken seriously by environmentalists as a reasonable alternative to the high environmental costs of coal power. While this argument offers an interesting perspective that differs from the others presented so far, it is in ways problematic. While it may ultimately be true that nuclear power has less of an environmental impact than coal, this type of statement is hard if not impossible to quantify. The problem comes in the fact that the types of waste created by these two processes are of such a different nature and have such different environmental impacts. Coal produces gas emissions and fine particulates. These emissions lower pH levels in oceans and other bodies of water (acidification) and create a greenhouse warming effect in the atmosphere. Nuclear waste,

48. P. B. Henault to the editor of *Conservation News*, December 10, 1970, Frank Church Papers, Boise State University Library, Boise, ID.

on the other hand, produces radioactive gas, liquid, and solid waste products that emit harmful radiation into the environment and can remain dangerous on geologic timescales. This radiation also has the ability to introduce genetic mutations into organisms and can disrupt genetic legacies in unpredictable ways. While Henault may not have known about the waste products produced by nuclear power generation and the dangers they pose to the environment, the fact remains that his statement about nuclear power having "no obvious harmful effects to our environment" is categorically false. Henault made a different kind of cost-benefit analysis and came out in support of the nation's nuclear program due to what he felt were overwhelming environmental benefits. In this way, Henault makes a very similar argument to the one pro-nuclear environmentalists are making today.[49]

While the NRTS was receiving some support from various groups in Idaho, overall the 1970s were a time of increased popular and political pressure to reform waste management practices. In 1972, the AEC announced that they were considering designating the NRTS as "an environmental research park." In light of the concerns surrounding waste disposal at the site, the designation of the site as an environmental research park was a way to combat increasing public scrutiny. As part of this proposal, the AEC would begin allowing ecologists onto the site to do studies on local plants and wildlife living inside the AEC's fences. Having outside ecologists studying the area

49. Van Munster and Sylvest, "Pro-Nuclear Environmentalism," 789-807.

would signal to people that it was safe and that local residents did not need to worry about the possibility of radiological exposure to themselves or their environment.[50]

Despite these attempts to change public opinion, the AEC found itself plagued by continued bad press. In 1973, the *Los Angeles Times* ran a multi-page exposé about the dangers that the AEC's waste disposal program posed to the American public. This article focused on a few of the problems at the NRTS in Idaho. According to the article, "Plutonium, the most carcinogenic (cancer causing) agent known to man and quite possibly the most dangerous substance on the earth, has been buried in ordinary steel drums at the National Reactor Testing Station near Idaho Falls, Ida., despite stern warnings that the drums would leak. Radioactive materials have been found in the ground water beneath the Idaho Falls Facility and could pose a serious threat to water supplies for much of the Pacific Northwest."[51] With a circulation of over a million people in 1973, a significant number of Americans saw this article. The facts included did not cast the AEC or the NRTS in a favorable light and would have just added to the fears of those already concerned about nuclear waste disposal in Idaho. Rather than try to refute this negative press, the AEC admitted that the basis for the article was factual. Just a few days later, the paper featured another article with this headline "Atomic Waste Story Factual, Official Admits" in which an AEC official admits that dangers and mismanagement existed in the AEC waste disposal programs. The official went on to try to minimize the seriousness of the problems reported by the paper by claiming that many millions of

50. *Idaho Statesman* "NRTS Site May Become 'Environ Research Park'," July 9, 1972.

51. Lee Dye, "Thousands Periled by Nuclear Waste," *Los Angeles Times*, July 5, 1973.

gallons of waste were managed by the AEC and only a small percentage of that total had ever leaked out of its containers. While intended to downplay the seriousness of the problem, this type of statement by the AEC would not have been reassuring to many in Idaho.[52]

In the wake of the high profile negative press that emerged in 1973, the following year saw several other organizations in Idaho speak out against the nuclear waste program at the NRTS. In October, the Idaho Grower Shippers Association (IGSA) released a statement of protest against nuclear waste storage on the Snake River Plain. This statement of protest outlined the position of the IGSA as follows: "The IGSA is not opposed to nuclear energy and its use in the generation of electrical power; however, the Association is on record by Resolution in opposition to Idaho becoming a storage area and/or dumping ground for hazardous, long-lived radioactive wastes that are generated outside the state… Our primary concern is water… and its vulnerability to contamination."[53] This interest group had a decidedly mixed message. The association sought to balance support for a large industry and employer in Eastern Idaho, while at the same time protesting what they saw as a danger to an essential natural resource and potentially a large number of vulnerable Idahoans. The other organization that came out in opposition of nuclear waste disposal in Idaho at this time was the *Idaho Water Users*

52. Lee Dye, "Atomic Waste Story Factual, Official Admits," *Los Angelis Times,* July 9, 1973.

53. Idaho Grower Shippers Association, *Statement of Protest: Nuclear Waste Storage on Snake River Plain – Idaho,* October 16, 1974, Frank Church Papers, Boise State University Library, Boise, ID.

Association. In a letter from that organization's executive director to Senator Church, they expressed their concerns this way,

> Tests conducted by the U.S.G.S. staff on site have shown a continual migration of Tritium and Strontium-90 down-gradient in the aquifer. In that time, those elements had drifted about eight miles. This, I think, is additional proof that such material can travel through the aquifer and potentially create problems for southern Idaho. If the aquifer becomes contaminated we may as well abandon the industrial and agricultural capabilities of the State. I do not wish to be counted with the preservationist groups that make such statements and try to ride on a wave of hysteria, nor do I wish to imply the A.E.C. and associated corporations are irresponsible. I do feel, however, that there is a significant potential for injury to Idaho's most valuable resource and that careful thought and deliberation must be put into a decision regarding the advisability of using Idaho as a nuclear discharge site.[54]

Like the earlier quote from the Idaho Growers and Shippers Association, this quote also shows the complex relationship that many continued to feel towards the NRTS in Idaho. The Water Association's primary concern of course was the possibility of contamination of a major source of water in the state. In the opinion of the association, protecting the Snake River Aquifer was essential to protecting the economic viability of the state of Idaho; as such, this had a decided impact on the types of costs the Water Association connected to the NRTS. Despite the seriousness and gravity of these concerns, and the obvious interest of the Water Association in protecting Idaho's water, the quote establishes reserved support of the NRTS and makes very clear that the Association supported industry in the state and did not want to be lumped together with the preservationist or environmentalist camp. Instead they wanted to make it known that their opposition was in order to protect various industries throughout the state. What the

54. Sherl L. Chapman to Senator Frank Church, November 20, 1974, Frank Church Papers, Boise State University Library, Boise, ID.

Water Association called for in this quote was an adoption of a kind of precautionary principle towards nuclear waste in the state of Idaho. This position allowed them to oppose what they saw as the most damaging costs of the nuclear project in Idaho while still maintaining much of the original benefits Idahoans had imagined in 1949. These two groups show a strain of opposition to nuclear waste that tried to balance environmental concerns with the economic realities in the state of Idaho.

Some were taking these measured tones in response to the criticism and questioning of the AEC, calling for increased caution in dealing with the AEC while at the same time still supporting the overall nuclear project in Idaho. On the other end of the spectrum, some in Idaho were totally rejecting any arguments about the benefits from the AEC's involvement in the state. A resident of Coeur d'Alene wrote to state governor Cecil Andrus to express these concerns,

> Much of this waste having already been dumped in very dangerous containers right above our great Snake Plain Aquifer which lies in an area subject to earth quake action and could in the event be liberated not only into our main water system but also into the air creating a very highly radioactive pollution which could destroy practically our entire Pacific North West… Do you consider our state and the people thereof so expendable that the environment, health, and the very lives of all living creatures with-in our boundaries so worthless that same maybe exposed to this dangerous elements or do you think it worth the efforts to investigate this situation.[55]

This is perhaps the most extreme type of reaction found during this period relating to the waste program in Idaho. For this writer, the NRTS's actions were of a potentially catastrophic nature. The idea that waste disposal in Idaho had the potential to destroy the

55. Edw. M. Martin to Governor Cecil D. Andrus, September 15, 1974 Frank Church Papers, Boise State University Library, Boise, ID. (edited from original to remove odd capitalization of several words in quote)

entire Pacific Northwest region or every living thing in Idaho is an extreme position. Although extreme, this view is also understandable. Americans first exposure to the capabilities of atomic fission came from the news reports after the Japan felt the devastating blow from America's atom bombs. If two relatively small bombs could cause that much destruction then why would a far greater amount of nuclear waste not be able to cause a much greater amount of devastation? For a person who viewed the stakes as being this high, straddling the fence between supporting the NRTS and condemning portions of the waste disposal program did not seem like an option. The costs in this scenario were severe and far outweighed the promise of any potential benefits. This person therefore expressed an almost total opposition to nuclear research in Idaho.

As section one established, early in the history of the NRTS/INEL the people of Idaho were either unaware or unconcerned about the dangers posed by nuclear waste in Idaho. This led to an optimistic view towards the benefits versus the costs of nuclear research in the state. Local ranchers laid the earliest foundations for such opposition when in 1957 they voiced their concerns that the benefits of the project were no longer worth the costs. This opposition was short lived because, like most shifts in popular understanding and awareness of social issues, the process of opposing nuclear waste in Idaho did not come together overnight. Instead, it took several decades for other groups within the state to begin to see mounting costs and static or shrinking benefits. When information about the waste disposal program at the NRTS finally found its way to the public, Idahoans had three broad types of response. Some Idahoan's still saw the costs versus benefits as largely in favor of local citizens. These Idahoans continued to express

their support for the nuclear project in Idaho and represent a continuation of the position Idahoans overwhelmingly expressed in 1949. Others rejected that position and focused on the mounting environmental costs to nuclear research. These Idahoans expressed little or no support for continued production or storage of nuclear waste in the state. Finally, others sought to find a middle way. These Idahoans wanted to preserve the best benefits of nuclear research for the state of Idaho while at the same time increasing the regulation of certain types of nuclear waste disposal within the state. These people hoped to protect both the environment of Idaho and its industry, including its nuclear industry. This reveals how Idahoans felt about and dealt with environmental issues within the state, and how Idahoans felt about the ways industry and the environment intersected. This shifting of cultural values and the ways Americans understood the costs versus the benefits of nuclear projects was not unique to Idaho, and by the 1980s controversy in another Western state showed the AEC just how much had changed in the nation since 1949. By tracing the ways that the broader American public was taught about and internalized information about nuclear science, it becomes easier to see how the public began to perceive nuclear projects as dangerous and in turn moved from support to opposition towards such projects. In the mid to late 1940s states were not opposing nuclear projects, but by the early 1980s something fundamental had changed in the way Americans understood the nuclear past, present and future of their country.

AFTER THE FENCES

> Radioactive wastes are essentially different in kind from wastes mankind has ever produced. Since they are both extremely dangerous and long-lived they must either be stored and perpetually monitored and maintained or disposed in some fashion so that they are no longer a threat to mankind. (Emphasis present in original)
>
> -Robert E. Trumbule, Analyst in Environmental Policy[56]

Broader American understandings of the costs versus the benefits of nuclear projects underwent a similar shift to the ones that occurred in Idaho. American mass media outlets interpreted the information about the benefits and the dangers of nuclear technologies and presented this information in ways that allowed average people to understand. Once this information was in the hands of the layperson, they gave that information context and meaning. By the 1980s, it was becoming increasingly clear that the way many American's had interpreted this information was that the costs of dealing with nuclear waste outweighed the benefits. Cautionary tales and the prevalence of nuclear opposition clearly demonstrate this. Ultimately, Americans began to shift the ways they thought about their environment.

The process of internalizing a growing body of information about the Cold War nuclear program into the broader American consciousness took time. In 1945, with America's use of two atomic bombs upon Japan, the world found itself abruptly shoved into a new atomic age. To use a colloquialism, the cat was out of the bag and the public

56. US Congressional Research Service, *A Review of Nuclear Waste Management Practices, Plans and Potential Problems*, by Robert E. Trumbule, Washington DC, 1974, Frank Church Papers, Boise State University Library, Boise, ID.

sought to understand the atom and its terrible yet mysterious power. Some of the earliest attempts to explain the science of the atomic age to the public came in the form of comic books. One example, the comic *Dagwood Splits the Atom,* was released the same year the AEC announced that Idaho was going to house the NRTS. In this comic, Dagwood and Blondie attempt to explain nuclear fission to a popular audience. These early comic books often offered a cautionary tale, urging children to learn about the atom and use its powers wisely.[57] At the same time, with the end of WWII, the AEC sought to calm nuclear anxieties by pushing the peaceful use of the atom in nuclear reactors. It was amid this atmosphere that the AEC began publishing pamphlets in order to explain to the public the basics of nuclear physics. Released for exactly this purpose, a pamphlet titled *The New Force of Atomic Energy* sought to dispel growing fears about the government's nuclear research program. One page, clearly intended to have a soothing effect, had many illustrations to make the science easy to visualize. Meant to pacify the reader, this page may have been inadvertently unnerving. The page explains different types of radiation with these captions, "Light radiation can be seen, heat radiations can be felt, x-radiations can't be seen or felt, radiations from radioactive materials cannot be..... seen, heard, felt, smelled, tasted."[58] The overall idea behind this type of explanation was to show that radiation is a normal part of life. Exposure to radiation in the form of light, heat, and x-radiation happened all the time to people in the early 1960s therefore the less common

57. Scott C. Zeman and Michael A. Amundson, eds., *Atomic Culture: How We Learned to Stop Worrying and Love the Bomb,* (Boulder: University Press of Colorado, 2004), 12-13.

58. U.S. Atomic Energy Commission, *The New Force of Atomic Energy: Its Development and Use*, Washington DC: Government Printing Office, 1961, 20. (Emphasis present in original)

alpha, beta, and gamma radiation was not very worrisome. There was, however, something inadvertently worrisome on the page. Even if radiation is normal, by the 1960s publicly available information showed clearly that certain types of radiation in high doses could be damaging or even lethal (as medical studies from Hiroshima and Nagasaki at the end of WWII made clear).[59] This makes the information about radiation being invisible to all human senses disconcerting at the very least. Lest the public's imagination get too out of hand the pamphlet goes on to inform the reader that alpha and beta particles only travel a few feet through the air before stopping. The science behind the growing cultural awareness of radiation was also beginning to gain traction during this period in the popular press. As early as 1957, *Time* magazine reported that the military was working on the development of bombs designed to kill people by exposing them to large amounts of short-lived radiation. Over the next several years, a number of national newspapers reported on similar weapons under development by the U.S. military. Articles describing these types of radiological weapons would serve to heighten fears of radiation within the context of Cold War militarization. [60]

Another influential medium seeking to explain the new atomic age to Americans in 1957 were television shows. In an episode of the popular *Disneyland* program titled, "Our Friend the Atom," Walt Disney Studios sought to explain the miraculous yet

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59. *New York Times*, "Close Study of Atom Bomb Victims," August 12, 1951, see also M. Susan Lindee, *Suffering Made Real: American Science and the Survivors at Hiroshima,* (Chicago: University of Chicago Press, 1994).

60. Scott C. Zeman and Michael A. Amundson, eds., *Atomic Culture: How We Learned to Stop Worrying and Love the Bomb,* (Boulder: University Press of Colorado, 2004), 67-68 and Jacob Darwin Hamblin, *Arming Mother Nature: The Birth of Catastrophic Environmentalism,* (New York: Oxford University Press, 2013).

equally dangerous world of nuclear physics.[61] Like many of the earlier comic book and government publications that sought to explain these same issues, "Our Friend the Atom" focused on the many great promises that nuclear technology held for the future. The hour-long program mentioned the possibility of nuclear airplanes, unlimited energy, healthier plants and livestock, and medical breakthroughs as all being just around the corner through the miracles of nuclear physics. The major cautionary tale from the program held a decidedly Cold War theme. The message was that since humanity had seen the terrible power nuclear physics unleashed in the form of nuclear bombs, it must now keep that destructive impulse in check and focus only on the utopian benefits of such research. Intended for a broad audience of families throughout the U.S. the program aired on the ABC network. It undoubtedly introduced many to one type of narrative concerning nuclear research, and what this research might mean for the average person. It also helped spread the message that people needed to be responsible with such powerful new technologies. In typical Disney fashion, it left the viewer feeling optimistic that nuclear research held the solution to the world's problems. While these popular sources played up the positive aspects of the Cold War nuclear project, other touchstones of popular culture saw something far more sinister.[62]

In 1962, the well-known comic book writer, Stan Lee, released the first comic in what would become one of Marvel Comics signature franchises. *The Incredible Hulk no.*

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61. This program had a long run on television and over the years went by various names. Perhaps the most well known iterations were *Walt Disney Presents* and *The Wonderful World of Disney*. All of these were the same program and maintained the same general format.

62. *Disneyland*, "Our Friend the Atom," Season 3 episode 14, (originally aired January 23, 1957) https://www.youtube.com/watch?v=QDcjW1XSXN0 (accessed February 11, 2016).

1 incorporated many pressing themes growing in American minds as the Cold War dragged on with no end in sight. Ideas about nuclear proliferation, radiation exposure, Soviet spying, and the unintended consequences of nuclear projects were integral pieces of the first issue's plot. However, there is one theme in particular that stands out: the underlying fear of radiation and its effects on the human body. This theme plays out in the life of Dr. Bruce Banner, who stands as a proxy for society as a whole. The comic begins with a test of a new immensely powerful weapon, the gamma bomb. Just as the countdown starts, Dr. Banner notices a car driving out to the test site. He immediately rushes out to try and save the teenager driving the car. Banner manages to save the young man but, as the narrator in the comic explains, "Altho' many miles from bomb zero, Dr. Bruce Banner is bathed in the full force of the mysterious gamma rays!"[63] In the aftermath of Dr. Banner's exposure to massive amounts of gamma radiation, rather than fall ill and die, he suffers a far more terrifying fate. The gamma radiation has somehow twisted Dr. Banner's very DNA so that whenever night falls he turns into a "...creature which fears nothing-- which despises reason and worships power!"[64] The mild mannered, rational scientist gives way to the uncontrollable and irrational nuclear monster.

To understand what is going on in this narrative it is essential to look to the broader social themes Stan Lee was channeling when he created The Incredible Hulk franchise. It may be obvious that in this early iteration of the Hulk's story, Lee was drawing heavily from a much earlier story, *The Strange Case of Dr. Jekyll and Mr. Hyde*,

63. Stan Lee, *The Incredible Hulk no. 1*, (New York: Marvel Comics, 1962), 4.

64. *Ibid.* 14.

first published in 1886. Of particular interest is the way in which he adapts the major themes of that story to reflect the fears about nuclear projects in the early 1960s. Lee's story describes gamma rays as mysterious, highlighting the fact that the average American of that time still felt that radiation and its effects were equally mysterious. Beyond that, the transformation that Dr. Banner makes into the beast known as the Hulk shows that nuclear fears were beginning to manifest themselves in American pop culture. When released in the form of a bomb or waste products, the power of the atom was an erratic, uncontrollable monster, just like the Hulk. If kept contained within the controlled setting of a nuclear reactor or physics lab then the power of the atom was like the rational, mild mannered scientist, Dr. Bruce Banner. Idahoans in 1949 understood the benefits of a nuclear laboratory much more in terms of the controlled rational scientist. The societal fear and anxiety about radiation was just beginning to surface in the late 1950s and early 1960s and Stan Lee drew heavily on these broad themes.[65] Taken as a whole, these examples show that while in the 1950s and early 1960s an understanding of the negative consequences of nuclear research and development had not yet entered the American psyche, when it came to nuclear waste, it was beginning to. This period was a time when a great deal of formerly unknown information about the government's nuclear programs was making its way to the public and as a result became embedded in popular thinking in important ways. By the 1980s, fears about radiation and nuclear waste were deeply rooted in the collective consciousness of Americans. Fears over nuclear waste arose in the intersection of science, environment, and the individual American's

65. Spencer R. Weart, *The Rise of Nuclear Fear*, (Cambridge: Harvard University Press, 2012).

experience during this period. It was this unusual combination of nuclear science, the environment of the West, and the lived experience of individuals that came to a head in the late 80s. This showed that when Americans made an analysis of the costs versus the benefits of nuclear projects they now emphasized mainly the costs. This calculation of high costs with low rewards was the reason government regulators found it difficult to gain traction on the Yucca Mountain project. In 1949, Idahoans in communities around the NRTS did not see these same costs. Three decades later the citizens of Nevada did and refused to give in to the government without a fight.

A number of scholars have commented on the ways information about nuclear programs influenced society and how various groups co-opted it during this period. Each of them has added to the understanding of the ways Americans viewed the government's nuclear projects in the Cold War period and allowed or resisted the ways these shaped the American landscape. Allison Macfarlane has argued, "...changes in scientific knowledge affected policy and, in turn, political considerations influenced the kind of scientific analysis being done and the questions asked... scientific knowledge cannot be separated from politics and associated policies. Rather, they co-evolve in response to each other."[66] Thus, for Macfarlane, the combination of scientific and political knowledge is the best way to explain the development of America's nuclear waste program. Jacob Darwin Hamblin takes a different approach. He argues that the "…collaboration between scientists and the armed services created a scientific worldview obsessed with

66. Allison Macfarlane, "Underlying Yucca Mountain: The Interplay of Geology and Policy in Nuclear Waste Disposal," *Social Studies of Science* 33 no. 5 (October 2003) 789.

environmental change, manipulation, and vulnerability."[67] For Hamblin it is the collaboration between scientists and the military that changed American society and the environment. Ultimately, Hamblin argues that this collaboration is what created the modern environmental movement and the ideas of global change that have become so influential. What both Macfarlane and Hamblin largely miss is the effect that information about the government's nuclear programs, in conjunction with popular representations of that information, has had on the types of costs and benefits the American public internalized during the Cold War period. This internalizing of information by the broader American public and the cost benefit calculations that arose because of it changed the ways people saw their environment and shaped the debates that have played out in relation to nuclear waste disposal. The examples already discussed present a clear picture of this process at work. The ranchers who found reasons to oppose the AEC early on through their use of local knowledge are the first example, and then later there is the example of many interest groups concerned about Idaho's water. In the lack of debates surrounding early waste disposal in Idaho that later moved into qualified opposition and in the controversy over Yucca Mountain, it is this local, on the ground understanding of nuclear issues, in conjunction with increasing governmental transparency, that offers the best explanation for these two very different outcomes. By the time Yucca Mountain was proposed as a repository site this process of internalizing the costs of nuclear projects was largely complete and those who opposed nuclear projects were making their voices heard in conspicuous way. These examples clearly show that science, politics, and the military

67. Jacob Darwin Hamblin, *Arming Mother Nature: The Birth of Catastrophic Environmentalism,* (New York: Oxford University Press, 2013), 11.

gain their broader historical meaning because they occur within a social context where people give them certain types of meaning.

We clearly see this re-evaluation of nuclear costs in the debates that swirled around the proposed nuclear waste repository at Yucca Mountain Nevada. The first time Yucca Mountain appeared in an article in *The New York Times* was on December 20, 1984. The headline of the article read "U.S. Names 3 Sites for Atomic Study" giving somewhat ambiguous ideas about why the government wanted to study these sites. If a reader took the time to move beyond the headline they would have learned that the three sites (Deaf Smith County in Texas, the Hanford Nuclear Reservation in Washington, and Yucca Mountain in Nevada) were being studied as possible sites for permanent disposal of highly radioactive waste. Already this first article announcing the sites contained signs of trouble. As discussed earlier during the late 1950s and throughout the 1960s and 70s the American public had gradually learned more information about radiation and its potential dangers. Americans had also steadily learned more about the problems with nuclear waste and some of the AEC's more problematic handling of that waste. Cold War fears about nuclear fallout and atomic annihilation rooted themselves deeply in the American consciousness during this period. Because of popular fears and the growing information about government waste disposal in the atomic age, by the 1980s it was no longer fashionable for most politicians to support nuclear projects. The announcement in *The New York Times* on December 20 was no exception. About halfway through the article the reader learns, "The Governors of Texas and Nevada promised to oppose

dumping the waste in their states."[68] Beyond the opposition from the governors, the end of the article also mentions a lawsuit by a number of environmental groups challenging the government's guidelines for assessing potential nuclear waste repositories. From this article, it is clear that popular public opinion was already galvanized against nuclear waste repositories before the Yucca Mountain project was even proposed.

The next article to mention Yucca Mountain in *The New York Times* did not appear until a month after the first. This article focused on the public reaction to the announcement of the sites proposed for study. In the opening lines of the article, the paper reported that, "In the three states selected as the possible site for a national nuclear waste dump, the ensuing argument divides those attracted by the money the project would bring and others who fear contamination. For most, the fears predominate."[69] This shows that while some were still clinging to the economic argument that Idahoans found so compelling in 1949, something significant had changed and created a groundswell of popular local opposition. No longer did Americans take for granted that the cost benefit calculation would mean mostly benefits with proposed nuclear projects. The article goes on to mention that groups of citizens in the three states selected for study had already formed to fight the siting of a waste repository near their homes. For these people it was their understanding of the dangers of nuclear waste that created a pathos of fear and opposition. The article cites three reasons for such anxieties. These reasons were the

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68. Associated Press, "U.S. Names 3 Sites For Atomic Study," *New York Times,* December 20, 1984, http://www.nytimes.com/1984/12/20/us/us-names-3-sites-for-atomic-study.html.

69. Iver Peterson, "Issue of National Nuclear Waste Dump Polarizes Three States," *New York Times,* January 25, 1985, http://www.nytimes.com/1985/01/25/us/issue-of-national-nuclear-waste-dump-polarizes-three-states.html.

possibility of accidents during the transportation of nuclear waste, worries about groundwater contamination, and the unknown effects of radiation on various geologic formations. Public anxieties about a potentially lethal force that was unobservable to human senses but that might end up in groundwater or the bedrock ran high. These ideas of the unpredictable nature of radiation, coupled with its invisibility, made the idea of a waste repository seem like a very costly proposition.

A number of public figures made statements that provide interesting examples of the ways that the increasing information about nuclear technologies mixed with local interpretations in unexpected ways that shaped public perception. A statement made by Texas governor Mark White illustrates this point, "Before the people of Deaf Smith County will glow in the dark, sparks will fly."[70] While clearly a hyperbolic statement, the governor's mention of a radioactive glow emanating from human bodies is a clear popular misunderstanding of the way radioactive contamination works. Only in rare and limited circumstances do radioactive materials glow, and they never do so in conjunction with bioaccumulation in plants or animals. Another statement, this time by the governor of Nevada, shows the same misunderstanding, "We don't want to replace the neon glow of Las Vegas with a radioactive glow."[71] Statements like these played off the public's fears about the costs associated with nuclear waste and helped to galvanized political support for the politicians making them. While radioactive materials very rarely glow, the popular

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70. Associated Press, "U.S. Names 3 Sites For Atomic Study," *New York Times,* December 20, 1984, http://www.nytimes.com/1984/12/20/us/us-names-3-sites-for-atomic-study.html.

71. *Iver Peterson,* "Issue of National Nuclear Waste Dump Polarizes Three States," *New York Times,* January 25, 1985, http://www.nytimes.com/1985/01/25/us/issue-of-national-nuclear-waste-dump-polarizes-three-states.html.

imagery was a useful rhetorical tool to allow political figures to touch on cultural fears related to a skewed understanding of the science behind nuclear waste. Examples like these show us how individual misunderstandings, by playing off fears about nuclear issues, could inflate the ways large groups of people thought about the costs of nuclear waste.

In responding to these fears, the Reagan administration issued a set of rules designed to govern the burial of high-level radioactive waste on August 15, 1985. These rules had the purpose of quieting public and political outcry in the three states named for a possible nuclear waste repository. Another purpose for these rules was ensuring radioactive substances remained isolated from the environment for approximately 10,000 years. The problem with these rules was that they inadvertently reinforced people's fears. Not only was radioactive waste dangerous in ways that are not visible but it remains dangerous on a time scale that humans can hardly imagine. To the well-informed citizen the idea of creating rules for nuclear disposal that could guarantee the isolation of nuclear waste for 10,000 years seems like a laughable work of science fiction. That is exactly what the federal government was trying to sell the public in the states of Washington, Nevada, and Texas in 1985.[72] It should come as no surprise then, that the public and more particularly their political representatives, were not pacified by these new rules.

The state of Nevada attempted to fight back against the Federal government by creating some rules of its own. In August of 1987, the Nevada legislature created a new

72. United Press International, "New Rules on Radioactive Waste," *New York Times,* August 16, 1985, http://www.nytimes.com/1985/08/16/us/new-rules-on-radioactive-waste.html.

county with the express purpose of dissuading the government from choosing the Yucca Mountain site for a nuclear waste repository. Named Bullfrog County, it covered 144 square miles surrounding the Yucca Mountain site. It contained no roads, no buildings, and most importantly no people. What it did have was an unusually high 5% property tax rate, the highest percentage allowed under the Nevada constitution at the time. This stunt had a dual purpose of creating a reason for the federal government to stop considering the site in Nevada and to pander to the overwhelming opposition to the project by the Nevada electorate. Nevada was also fighting back in other ways. By this same time, the state had filed five lawsuits against the U.S. Department of Energy (DOE) in an attempt to end the federal government's consideration of the Yucca Mountain site.[73]

Despite Nevada's concerted efforts, on December 17, 1987 the U.S. House and Senate agreed on Yucca Mountain as the sole site for the nation's high-level nuclear waste repository. This agreement was three years ahead of the federal government's own timetable for final site selection and represented a great deal of political maneuvering.[74] Initially devised in the U.S. Senate as a cost saving measure, the early narrowing from three sites to one would not only save an estimated $4 billion, it would also receive strong support from the U.S. House whose Speaker and majority leader were from Texas

73. Thomas J. Knudson, "Bullfrog County, Nev., (Pop. 0) Fights Growth," *New York Times,* August 30, 1987, http://www.nytimes.com/1987/08/03/us/bullfrog-county-nev-pop-0-fights-growth.html.

74. Susan F. Rasky, "Accord is Reached on Nuclear Dump," *New York Times,* December 18, 1987, http://www.nytimes.com/1987/12/18/us/accord-is-reached-on-nuclear-dump.html and, *New York Times*, "Nuclear Waste Plan Angers 2 Western States," (June 8, 1986) www.nytimes.com/1986/06/08/us/nuclear-waste-plan-angers-2-western-states.html.

and Washington respectively.[75] In reality, it probably saved the federal government more than $4 billion considering that missed deadlines and cost overruns plagued the Yucca Mountain project from the beginning, and that surely would have also happened during the exploration period at the other two sites. Shortly after this decision, the state of Nevada received another blow, on February 12, 1988 a district court judge declared the formation of Bullfrog County illegal.[76] Seemingly left with no recourse, the Yucca Mountain project began to seem inevitable.

Popular opposition can play out in many ways, and what seemed inevitable in the early months of 1988 would begin to seem less so as time went on. Just under a year after the creation of Bullfrog County was declared illegal, an article appeared in *The New York Times* with the headline "Work is Faltering on U.S. Repository for Atomic Waste." The article reported that after only one year of work on the project the government was struggling to meet its own standards for safety and site suitability. The fact that when the government made Yucca Mountain the only site for a waste repository they had not created any backup plan should the site fail in its intended purpose only compounded the problem. In the article, the DOE project manager for the Yucca Mountain project defended the project in these terms, "This is one of the most closely reviewed programs ever undertaken by the Federal Government... In my view, it's impossible for us to build

75. *New York Times,* "Nevada's Radioactive Jackpot," January5, 1988, www.nytimes.com/1988/01/05/opinion/nevada-s-radioactive-jackpot.html.

76. Associated Press, "Nevada County is Held Illegal," *New York Times,* February 13, 1988, http://www.nytimes.com/1988/02/13/us/nevada-county-is-held-illegal.html.

it wrong."[77] What this manager failed to comprehend was that while the Yucca Mountain project may have had close government oversight it was also one of the most publicly scrutinized projects ever undertaken by the US government. This local Nevada opposition would continue to bog down the project for decades.

By the time the federal government began looking for a permanent nuclear waste repository in the 1980s something fundamental had changed for Americans. No longer did American's share the optimism and trust that defined the people of eastern Idaho in 1949 and led them to see the NRTS as beneficial to their communities and state. While some were making a case that embracing the Yucca Mountain project would bring economic benefits to the state, what is striking is the lack of traction these types of arguments got. In Idaho, these initial arguments provided a strong reason for the public to embrace nuclear research. Once these benefits were in place in Idaho it was much more difficult for politicians and interest groups to fully oppose the nuclear project in Idaho because opposing nuclear was seen as opposing Idaho industry. Despite all of this, limited forms of opposition still materialized in Idaho. In Nevada the opposition was immediate and had a strength that never materialized in Idaho. Comparing these examples makes it clear that a societal shift had taken place and at its heart was the way that Americans understood the dangers nuclear waste posed and the ways that understanding changed the cost-benefit calculations that took place.

77. Matthew L. Wald, "Work is Faltering on U.S. Repository for Atomic Waste," *New York Times*, January 17, 1989, http://www.nytimes.com/1989/01/17/us/work-is-faltering-on-us-repository-for-atomic-waste.html.

CONCLUSION

> The problem is how to keep radioactive waste in storage until it decays after hundreds or thousands of years. The deposit must be absolutely reliable as the quantities of poison are tremendous. It is very difficult to satisfy these requirements for the simple reason that we have had no practical experience with such a long term project. Moreover, permanently guarded storage requires a society with unprecedented stability.
>
> -Hans Alfven, Nobel Laureate in physics[78]

In the years just following the end of WWII, Idahoans and the broader American public bet on the promise of a bright nuclear future. In adopting this optimistic view of government research, Idahoans in particular counted on their understanding that such research would bring a wealth of benefits to the state with little to no permanent costs. With the advantage of hindsight this view seems simplistic, overly optimistic, and more than a little naïve but for Idahoans at the time it was their lived reality. Many dominant societal pressures led to this kind of thinking at the time. Americans gave unprecedented trust to a government and its scientific achievements, which had just won WWII. When scientists and politicians told the American public that some of the most promising new scientific frontiers lay in the fields of nuclear physics and the closely related particle physics, Americans believed them.

Most Idahoans continued to believe in this promise for well over a decade until information about the potentially high costs of nuclear projects began to emerge in the midst of a rapidly changing American social landscape. The strain of the Cold War era

78. Terry R. Lash and John E. Bryson Esq., "Citizens Guide: The National Debate on the Handling of Radioactive Wastes from Nuclear Power Plants," (Palo Alto: Natural Resources Defense Council, 1974) ii.

found expression in a lack of trust in government. News stories that talked about the failures by the AEC in their nuclear waste disposal and management efforts only reinforced this view of government. The more people in Idaho became aware of these issues, the more the costs of nuclear research began to outweigh its benefits. As Idahoans and their state government re-evaluated their relationship with the NRTS and the AEC, most sought to recapture what they saw as the original bargain they had struck. This meant an end to the waste disposal program in Idaho, shipping the waste to a permanent repository in another state, but otherwise leaving the nuclear facilities in Idaho unchanged. This would eliminate the largest costs within the state while at the same time creating only a minimal loss of federal spending on the NRTS, thus retaining the economic benefits to the state. In Idaho, everything seemed to revolve around a careful economic calculus. The state of Idaho could not afford to lose a major source of federal funds flowing into the state's economy, at the same time they could not allow a federal project to potentially contaminate a huge aquifer and put at risk a majority of the state's agriculture. In an overwhelmingly rural state that counted agriculture as one of its leading industries, Idahoans could not tolerate anything that might raise doubts about the safety of the state's produce. For the majority of Idahoans a compromise was the only viable path forward; lose some economic benefits by shutting down the nuclear waste disposal programs in the state but in the process ensure the safety of the state's natural and agricultural resources.

This change in the understanding of the costs versus the benefits of nuclear industry in the state led Idahoans to think about water in the state in a new way. Before

concerns over nuclear contamination, water in the Snake River Plain Aquifer had been a given. Outside of disputes over water rights and ensuring the proper irrigation of crops, people did not think about the aquifer as something that needed protection, it was just there. After the possibility was raised that industry could contaminate that water source in a way that would last for a very long time, that water became a precious and vulnerable resource that needed the protection of the state and its people. By the mid to late 1970s, Idahoans were beginning to think about their environment in new ways and concerns over water in the Snake River Plain Aquifer is just one example.

The example of the Yucca Mountain Waste Repository gives an important reference point to show how another group of Americans in the Western US responded much differently in the 1980s than the people of Idaho in their dealings with the NRTS. While Idahoans initially made a calculation of overwhelming benefits of a nuclear project in 1949 and then were forced to renegotiate that analysis as they learned more about nuclear waste disposal and its risks, in Nevada the costs of nuclear waste disposal were immediately apparent and overwhelmed any talk of potential benefits. By the time congress settled on Nevada for a permanent nuclear waste repository, the ways Americans understood government nuclear projects had changed radically. No longer was there a sense of optimism that nuclear science and technologies could provide answers for the world's greatest challenges. The societal forces that developed to deal with the Cold War threat of nuclear annihilation came to represent the government's nuclear projects in a much more unfavorable light then they had at the end of WWII. By

the late 1970s, nuclear opposition came to represent the dominant social response to nuclear programs in the United States.

As the world moves into a new period dominated by worries over anthropogenic greenhouse gas emissions, the cost-benefit analysis on nuclear projects is beginning to shift again. This time the costs environmentalists are weighing are the catastrophic effects of significant increases in global temperature leading to a permenantly altered biosphere versus the relatively lower cost of nuclear waste generated by the adoption of a new generation of nuclear power plants. Some environmentalists, who a few decades ago were in adamant opposition to all things nuclear, are now calling for the large-scale adoption of nuclear power on a global scale. In the midst of such current debates, understanding the ways Americans have understood the costs versus the benefits of these types of projects in the past and the ways these beliefs changed over time is now more important than ever.

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APPENDIX A

U.S. NUCLEAR HISTORY TIMELINE

U.S. NUCLEAR HISTORY TIMELINE

December 2, 1942: The world's first nuclear reactor goes critical at the University of Chicago

August 6, 1945: U.S. drops the first atomic Bomb on Hiroshima Japan

August 9, 1945: U.S. drops a second atomic bomb on Nagasaki Japan

August 15, 1945: The Empire of Japan surrenders, V-J Day

March 22, 1949: The AEC announces the Idaho site as its choice for the NRTS

August 29, 1949: The USSR successfully tests its first atomic bomb

August 24, 1951: The first reactor at the NRTS (Experimental Breeder Reactor-I) is turned on for the first time

December 20, 1951: First electricity from nuclear power generated by EBR-I at the NRTS

September 27, 1962: *Silent Spring*, an important book in the early environmental movement, is first published

March 18, 1967: The state of Idaho begins its first attempt at oversight of activities related to nuclear research within the state.

October 11, 1974: Energy Reorganization Act of 1974 signed into law. The act disbanded the AEC and replaced it with the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA)

August 4, 1977: The U.S. Department of Energy is formed as a new cabinet level agency in the executive branch with responsibilities over nuclear waste management

March 28, 1979: Due to a series of failures, the reactor at Three Mile Island, PA partially melts down, heightening public awareness of nuclear dangers

December 20, 1984: The Department of Energy announces the study of 3 possible sites for a permanent nuclear waste repository

April 26, 1986: Chernobyl Nuclear Power Plant in Pripyat Ukraine catastrophically melts down

December 17, 1987: The U.S. congress passes legislation making the Yucca Mountain site in Nevada the only site for consideration for the permanent nuclear waste repository.