UNIVERSITY OF CALIFORNIA, MERCED

# Nuclear Waste: Policies, Risks, and Economic Impacts on the State of Idaho

by

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A Dissertation Submitted in Partial Fulfillment of Requirements For the Degree of Doctor of Philosophy in Interdisciplinary Humanities (American History)

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# Words and Acronyms

AEA = Atomic Energy Act

AEC = Atomic Energy Commission

ANP = Aircraft Nuclear Propulsion Program

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

COLD WAR = A period of ongoing geopolitical tensions between the Soviet Union, United States and its Western democracies

DW = Decommissioned Waste

DOD = Department of Defense

DOE = Department of Energy

DON = Department of Navy

Embargo = Oil embargo in 1973 by the OPEC

EPA = Environmental Protection Agency

ERDA = Energy Research and Development Administration

EURATOM = European Atomic Energy Community

GNEP = Global Nuclear Energy Partnership

ICCP = Idaho Chemical Processing Plant

INEL = Idaho National Engineering Laboratory, and today's the INL

INL = Idaho National Laboratory

JCAE = Joint Commission on Atomic Energy

LLW = Low Level Waste

HLW = High level Waste

INTEC = Idaho Nuclear Technology and Engineering Center

MRS = Monitored Retrievable Storage

NAS = National Academy of Sciences

NRC = Nuclear Regulatory Commission

NRTS = Nuclear Reactor Testing Station

NWF = Nuclear Waste Fund

NWG = National Waste Graveyard

NWPA = National Waste Policy Act of 1982

NWTF = Nuclear Waste Task Force formed in 1979

NPT = Non-Proliferation Treaty

OPEC = Organization of the Petroleum Exporting Countries

PLUTONIUM = A radioactive metallic element created in nuclear reactors

RFWF = Rocky Flats Weapons Facility

RNW = Radioactive Nuclear Waste

RWMC = Radioactive Waste Management Complex

SNF = Spent Nuclear Fuel

SRA = Snake River Aquifer

STRONTIUM = A soft silver-white metal of the alkaline earth series.

TSA = The Settlement Agreement of 1995

TRA = Test Reactor Area

TW = Transuranic Waste

URANIUM = A radioactive chemical element and a nuclear fuel

WIPP = Waste Isolation Pilot Plant

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# Abstract

My dissertation project seeks to examine the challenge of storage, packaging, and disposal policies of radioactive nuclear waste (RNW) at the Idaho National Laboratory (INL). The INL sits on top of the Snake River Aquifer, which is the largest water resource for Idaho residents and farming communities. In the 1940s, the U.S. government negotiated the establishment of the INL by enticing the State of Idaho with a substantial economic package, promise of high-tech jobs, and participation in research of nuclear and other technologies. In 1961, the first commercial nuclear accident in the world happened at the INL; a Breeder nuclear reactor explosion destroyed the structure, killing three workers, and the radiation escaped into the atmosphere. Later, in 1976, the Teton Dam collapse resulted in killing many people, causing millions of dollars of crops and property damage, and the floodwaters gushed through the RNW trenches at the INL. These events solidified the dangers of nuclear technology and the fear of contamination of the Snake River Aquifer in the minds of Idaho residents. In addition, reports of RNW being poured directly into the Snake River from the INL eroded any credibility U.S. government had established through numerous promises of safe and comprehensive RNW policies. As the volume of RNW grew at the INL so did the fear of contamination of the Snake River, the Idahoans drew parallels with the Columbia River, Washington which had been contaminated with high-level RNW from the leaking storage tanks at the Hanford Reservation. After many broken promises by U.S. officials, Idaho politicians and residents raised their voices in protest against the storage, packaging, and disposal of RNW at the INL and demanded their removal outside of Idaho into a permanent repository. The U.S. government did not have a comprehensive RNW policy in the country and no state wanted a RNW repository in their territories. Governor Cecil Andrus directed the Idaho State Troopers to block boxcars carrying RNW from Rocky Flats facility in Colorado. Later, in 1991, the State of Idaho and the Shoshone-Bannock Indian tribes sued the U.S. government demanding removal of all RNW from the INL complex to a permanent repository outside of Idaho, and no more RNW shipments to the INL. In 1995, a Settlement Agreement was reached between both parties that required RNW to be removed from the INL by 2035. However, many shocked Idahoans pointed out shortcomings of the Settlement Agreement which might provide U.S. government further access and leverage.

According to reports, eastern- Idaho residents are not worried about RNW storage and disposal at the INL which suggests that the residents of eastern-Idaho benefit monetarily due to the economic stimulus provided by the INL's location. This study utilizes various primary and secondary sources in an historiographical manner to understand how the INL became a nuclear waste dump from a nuclear research laboratory and how it is still playing an important role in the research of nuclear and other technologies. Further analysis of archival and research data will aid in understanding how the monetary benefits from the INL are centered in eastern-Idaho region, while the fears of RNW

contamination of Snake River Aquifer are still present. What results have the U.S. RNW policy produced in the country? Why is production of nuclear weapons, energy, and other usages highlighted, while the nuclear waste storage and disposal issues are ignored? The study reveals how the lack of a comprehensive RNW policy has put the health and safety of present and future generations of Americans at risk.

# Introduction

The world polity was stunned by the ferocious nature of nuclear bombs dropped on two Japanese cities at the end of the Second World War. U.S. government sought to continue their atomic energy dominance by supporting and promoting peaceful applications intended for commercial nuclear energy, medical and academic research projects, along with its destructive power. Alvin M. Weinberg, a nuclear physicist told the U.S. Senate's Special Committee on Atomic Energy in December 1945, "Atomic power can cure as well as kill. It can fertilize and enrich a region as well as devastate it. It can widen man's horizons as well as force him back into the cave." The Atomic Energy Commission (AEC) was responsible for nuclear materials production, weaponization and establishing safety standards. However, there was not a whole lot of attention paid to the nuclear waste storage and disposal practices and permanent repository. What is nuclear waste and how does it impact the environment, marine life, water, and human beings? This question has arisen again and again while researching and writing about the nuclear waste in Idaho while reviewing the government policies, history, and its future. I became aware of nuclear waste issue in Idaho after listening to a lecture about Rocky Flats weapons facility in Colorado, where plutonium triggers for nuclear weapons were manufactured and the high-level nuclear waste generated there was shipped to Idaho for 'temporary' storage and disposal. The speaker spoke about the Idaho National Laboratory's (INL) isolated location in eastern-Idaho desert, how it sat on top of the Snake River Aquifer, and criticized U.S. government's policies regarding packaging, storage, and permanent disposal of nuclear waste. This lecture made me think about the hazards posed by nuclear waste to the environment, water, marine life, and human beings, while wondering what an important role the INL was playing in the global nuclear technological sphere.

My project overviews the storage, packaging, disposal and retrieval policies and practices related to radioactive nuclear waste at the Idaho National Laboratory, which is located in the eastern-Idaho desert. The aim of this research project is not to compile history of the INL, nor it is a technical assessment of the technological research that has been conducted there but my motivation is to identify the policies and political conditions of its evolvement from a research laboratory to a nuclear waste dump. Furthermore, the INL is a multi-dimensional entity that cannot be identified with a single technology or product as they have a long list of trademarks and patents in many different fields of expertise. The INL achieved commercial nuclear energy, which produces highly radioactive and hazardous waste that needs to be managed in ways that safeguard human health, minimize the impact on the environment, and are isolated from biosphere for a significant amount of time. Additionally, the residents of Eastern-Idaho were not excited

by the constant demands by the Idaho politicians and residents to remove RNW from Idaho, as they were not convinced if nuclear waste at the INL could contaminate the Snake River Aquifer. Although many environmental activists, business leaders, residents and politicians of Idaho were convinced that radioactive nuclear waste (RNW) at the INL would contaminate Snake River Aquifer sooner or later due to AEC's lax and ad-hoc policies and practices. In order to assuage these demands, U.S. government made promises after promises to remove the RNW from the INL, but these promises were never kept. In addition, this paper examines how does the economic stimulus generated by the INL helps the socio-economic growth in the adjacent six counties in various different forms.

There hasn't been a whole lot written about how the INL became a nuclear dump, as there are many political, administrative, logistical, technological, and economical reasons that this paper will try to cover. A subgovernment model of policymaking was implemented without any public participation. In this paper, there is a sufficient amount of direct and indirect background information about the formation of the AEC and its structure, the establishment of the INL as a nuclear reactor testing station, the Cold War pressures, safety matters and business with the Western Allies, and the fear of nuclear waste contamination of the Snake River Aquifer. The OPEC oil embargo of 1973 brought a major shift in U.S. energy policy. In 1974, the AEC was abolished, ERDA and NRC were created. The Site Selection for a geologic repository has many political, environmental, and economic problems. Idaho is prone to natural and manmade disasters, and that is why the residents of Idaho became skeptical about the safety of the ever-growing volumes of nuclear waste at the INL The U.S. government did not have a comprehensive nuclear waste policies and mechanisms in place from the day one. This project provides the readers with pertinent information about the nuclear waste technology, storage, disposal, and retrieval at the INL, and how it has made its mark on the state of Idaho through its economic stimulus that helps the adjacent six counties in eastern-Idaho. My archival research through various primary and secondary sources, and in-person conversations with officials, activists, academics, and others gave me the confidence to select materials, archival evidence, formal and informal information that points to positive and negative developments at the INL regarding the policies of storage, packaging, and disposal of the nuclear waste. My research identifies that first the AEC, later, NRC failed to implement rules for commercial and defense wastes because they have been focused on the front-end production. The INL generated its own nuclear waste from its numerous reactors, later, it started receiving wastes of varying degrees from national and international sources. Experts agreed that the nuclear wastes are hazardous to the environment, water, marine life, and humans. This in mind, many Idaho residents raised the alarm of contamination of the Snake River Aquifer by the INL nuclear wastes, while some said that the U.S. wastes policies were science based and safe. Since, there have been many nuclear wastes related accidents in various parts of the country, Idaho

politicians and residents demanded the U.S. government remove and transfer all nuclear wastes from the INL to a geologic repository outside of Idaho.

Through archival research, it has been observed that at the INL there are a variety of radioactive and chemical wastes sources that have disposed of large volumes of nuclear wastes into the Snake River Aquifer. The Teton Dam collapse in 1976 brought gushing flood waters to the pits and trenches at the INL. U.S. government wanted the Carey mine, Lyons, Kansas to become the geologic repository, however, the Kansas Geological Survey announced that a large volume of water disappeared inside the mine while cleaning of the sediments. The NWTF recommended safer methods of storage and disposal of RNW to the INL, but they were denied. The Cold War ended with the collapse of the Soviet Union; it brought more high-level RNW to the INL due to mutual deweaponization of the nuclear arsenal. In 1954, the Rocky Flats, CO started sending their nuclear wastes to the INL, and the RNW being sent to the INL did not have clear markings or designated nuclear wastes as required. The AEC designated the INL as a commercial nuclear waste dump from 1960-1963. The Three Mile Island nuclear reactor meltdown debris was sent to the INL for research and storage by railcars.

In 1950s, the AEC presented commercial nuclear energy as too cheap to meter, however, once we add the storage, disposal, transfer, transport, and repository cost, it is more expensive than the other modes of energy. In addition, they did not talk about how to deal with the back-end issue of nuclear waste because it was an unimportant issue for them. Most of the RNW at the INL are either high-level or transuranic wastes, which are mostly in liquid form, but also there are some solid, and gaseous wastes. The INL reprocessed Nuclear Spent Fuel from 1953-1992. Later, U.S. government banned reprocessing due to the fears of proliferation. By early 1970's a deep geologic repository for high-level RNW was still a theory, and the state of Idaho was still waiting for the U.S. government to the remove RNW from the INL. The Low-Level Radioactive Waste Policy Act of 1980 brought compact agreements by states, which turned into a political, territorial, economic, and logistical nightmare. In 1975, U.S. government announced to build a geologic repository in New Mexico where they would deposit military transuranic waste, which are temporarily stored at the INL. In 1982, the NWPA provided a framework for the disposal of the spent fuel assemblies and high-level RNW, while the Department of Defense (DOD) was responsible for the design, construction, and operation of a geologic repository. In 1987, three sites were selected but only Yucca Mountain site was recommended to be the repository for high-level RNW. The DOE gave up on a site selection for a repository in the east and west coast was the only option. After successful tests, Yucca Mountain was recommended to be the Study Experiment Site. In 2002, Yucca Mountain project was given light to start construction for geologic repository, where most of the high-level RNW temporarily stored at the INL would be transferred. The people of Nevada prevailed, and the Yucca Mountain project was suspended in 2010. The high-level RNW temporarily stored at the INL will have to wait for a permanent repository.

In 1995, the U.S. government and state of Idaho reached a Settlement Agreement after consuming their energies and resources in a long-drawn-out legal battle in the District Court. The Agreement established a timeline for the removal of transuranic wastes from the INL. The Spent Nuclear Fuel shipments were restricted to the national security requirements, a waste treatment would be built at the INL, and all RNW should be removed by 2035. Due to extensive environmental contamination by the nuclear waste at the INL, an Environmental Restoration Program would be established by the U.S. government. According to many Idaho residents, this is not a perfect agreement, however, if the Agreement is complied with, then there could be several things that could create a positive impression of better results for the residents of Idaho. The Agreement gives state of Idaho the right to waive performance of the federal parties of any terms and conditions, which gives them the opportunity to avoid an injunction/delay if there is a dispute in the process. Idaho shall issue the licenses or permits for the Navy Propulsion Program. All parties are restricted to perform under the conditions of the Agreement. The Court instructs the state of Idaho not to withhold approval for modifications. U.S. Navy would not send any more Spent Nuclear Fuel to the INL and Department of Energy would also not send any more shipments of Spent Nuclear Fuel. The Court would enforce the rights and obligations assigned under this Agreement, which is legally binding upon both parties. The Agreement obligates the federal government to remove all Spent Nuclear Fuel at the INL by January 1, 2035, and if they do not comply with the deadline, then they will pay a fine of $60,000 per day. If there is a dispute among both parties, they can ask the Court for a resolution of the matter.

The U.S. government's nuclear waste storage and disposal policies have not been comprehensive in nature, and due to the ad-hoc nature of the structure of the AEC there has been no public opinion taken into consideration of the nuclear technology matters. Although U.S. government tried to establish a high-level RNW repository at the Carey mine, Lyons, Kansas but after the project was suspended, there has been no other state that was willing to open their territories to have a geologic repository. The U.s Government built a repository for transuranics defense wastes at Carlsbad, New Mexico. Although the U.S. government tried to change the classification of the stored waste, so they could include the high-level RNW, but they got stiff resistance from the New Mexican politicians and residents. The U.S. government failed to establish repository in the east coast states due to pressure political and civil communities. The U.S. government tried to build a high-level repository at the INL, but the Snake River Aquifer is only six hundred under the INL complex, which makes it impossible for the construction of a deep geologic repository.

The lessons we have learned from the research of radioactive nuclear waste storage and disposal policies that there are many political, social, environmental, legal, and economic hurdles U.S. government has to overcome before they come up with a satisfactory proposition that is acceptable to all parties. However, it is clear that no state wants to offer a site for a repository in their territories, which leaves the U.S. government

without any alternatives, and they have asked the nuclear energy providers to increase their storage capacities to store the RNW onsite on temporary basis. The considerations and responsibilities of nuclear weapons program, the security of the Western Allies, and international nuclear agreements puts the U.S. government under pressure to find a permanent solution to the ever-growing volumes of high-level RNW. In my opinion, Yucca Mountain was the best option for a deep geologic repository to store and dispose high-level RNW, however, since that option is no longer on the table I don't see a clear answer to this question. Onsite storage at the nuclear facilities is the best strategy at the moment, and as the technology becomes more efficient, maybe there could be a better solution to this problem.

# Chapter 1

## Atom to Nuclear Waste

After the First World War ended, people around the globe recognized the terror of technologically advanced weapons would bring about a new age of peace and calm amongst nations in the near future. Several years later, in 1921, a journalist wrote that "When we have discovered the secret of the atom, it is likely that all nations will be ready and willing to lay down their arms and abolish their armies and navies."[1] His prediction almost came true; at least for a while; the U.S. government, through "The Manhattan Project," developed and began the first nuclear weapons program. The ferocious nature of the atom was demonstrated in August 1945 when American bombers dropped two nuclear bombs over Japanese cities of Hiroshima and Nagasaki, demanding an unconditional wartime surrender by Imperial Japan. The ferocity of the new weapon stunned the world polity, and this unassailable weapons-based advantage made the United States of America a military super-power in the world. In order to capitalize on their nuclear technological prowess after the end of the Second World War, the U.S. government decided to expand atomic technology for defense and commercial purposes. In order to develop atomic technology to meet defense security parameters and commercial applications, the United States Atomic Energy Commission (AEC) was established in 1946 through the enactment of the Atomic Energy Act (AEA). The AEC became responsible for safety regulations and standards of the peacetime development of atomic science and technology.

Later, the AEC's role of environmental and civilian safety, along with nuclear weapons production, made it difficult to implement comprehensive nuclear policies and practices. Specifically, the nuclear waste policies of repository site selection, storage, packaging, disposal, and retrieval were challenging for the AEC because of the inherent conflict between their obligations to civilian safety and expanding their nuclear weapons program in response to global and Cold War pressures. The AEC encouraged research efforts designed to apply the technologies developed under "The Manhattan Project" to a variety of fields and technologies, and for this purpose many nuclear research laboratories and plants were designed and established. In 1949, the National Reactor Testing Station (NRTS), an expansive 890-square-mile complex in the eastern-Idaho desert was established forty miles west of the City of Idaho Falls to serve as a hub of atomic innovation and technology. Today, NRTS is known as the Idaho National Laboratory (INL) that has been home to fifty-two nuclear reactors, and all but three reactors have been decommissioned. The INL continued technological innovations and generation of electricity, while accumulating spent fuel and other radioactive nuclear waste (RNW) materials without having a clearly defined long-term disposal or removal strategy. Since the INL sat on top of the Snake River Aquifer, the Idaho residents became concerned about the contamination of precious underground water resource for over

[1] Spencer R. Weart, *The Rise of Nuclear Fear* (Harvard University Press, 2012), 13-14.

300,000 Idaho residents from RNW stored there in large quantities However, the eastern-Idaho residents were not as concerned about the contamination of the Snake River Aquifer because they believed that the INL administration followed proven and safe nuclear waste policies specified by the AEC. My research project examines a variety of primary and secondary sources, archival and governmental data, and in-person sources to find out U.S. nuclear waste policies and practices that were implemented or not implemented to safeguard RNW at the INL. Furthermore, how did the INL economic stimulus changed political and social views in eastern-Idaho regarding the RNW storage, disposal, and removal.

## U.S. Atomic Bureaucracy

By the late 1940s, the Cold War was at its peak and the U.S. government wanted to boost its technological prowess over the Soviet Union, who had detonated their first nuclear device in 1949. The Cold War intensified greatly over the next two years due to the Berlin Blockade, the loss of China and Czechoslovakia to the Communists, the discovery of atomic spies, the growing concern about Communists within the U. S. government, the Soviet detonation of an atomic bomb, and the start of the Korean conflict all resulted in a heightened tensions and anxiety.[2] The AEA setup the AEC as a five-man commission, all civilians who served as the President's arm in the technical world of atomic energy. In addition, the Joint Committee on Atomic Energy (JCAE) was set up comprising of nine senators and nine representatives to keep the public representatives aware of current projects and future developments. Furthermore, the Cold War as a backdrop, the JCAE was granted extraordinary powers and independence in order to fulfill their national responsibilities. Furthermore, the JCAE was established to create a checks-and-balances system of American government, so not to have a single person or the AEC, as an agency having unchallenged powers or authorities. Conceptually, the AEC was a technical organization that would initiate ideas and policies and present them to the American representatives and the public, while the JCAE, a public serving entity would hold open hearings where information provided by the AEC is discussed; ideas are accepted and modified. In addition, the JCAE has been involved in the development of the national energy laboratories; standards and impacts of nuclear energy; and nuclear waste management policies and plans.

President Harry S. Truman signed the McMahon/Atomic Energy Act to establish the AEC, which promoted and regulated the peacetime development of atomic energy and other related technologies. Later, on January 1, 1947, the control of atomic energy was transferred from military to civilian hands. This shift in policy gave the AEC members complete control of all thirteen U.S. weapons plants and laboratories, equipment, and personnel working in various capacities to produce atomic weapons and other related products. The AEC declared that its primary goal was to enact "a program for Government control of the production, ownership, and use of fissionable material to

[2] Philip L. Fradkin, *Fallout: An American Nuclear Tragedy* (Tucson: The University of Arizona Press, 1989), 84.

assure the common defense and security, and to ensure the broadest possible exploitation of the field." Under the circumstances, the newly formed AEC faced many

The INL Complex – Figure 1.1, Madelyn Beck, “The Pentagon is sending a new Nuclear Design to Idaho,” Boise State Public Radio News, Published April 15, 2022. https://www.boisestatepublicradio.org/science- research/2022-04-15/the-pentagon-is-sen

challenges to meet the security demands of an anxious nation. President Harry Truman appointed David E. Lilienthal, the first chairman and Carrol L. Wilson, the general manager of the AEC, and they were responsible for procurement and weapons production programs due to the Cold War pressures. The AEC almost immediately had to put the majority of their resources into nuclear materials development, while the peaceful energy program was put on a backburner. For security purposes, all weapons and nuclear facilities were owned by the U.S. government, and they were operated/maintained by private contractors. In order to meet the expanding requirements for more fissionable materials, the AEC decided to refurbish and expand the weapons production and research facilities that were built during the Second World War. Furthermore, the AEC planned to build more nuclear reactor research/testing, plutonium production, and other pertinent facilities in order to meet high demand for nuclear weapons. Although in 1943, the Quebec Agreement between the United States and Great Britain had created a wartime partnership to work together on atomic research and collaboration. However, the expansion of nuclear technology programs within two countries was not enough because many other nations were interested in gaining from the U.S. atomic energy prowess.

## International Pressures on U.S. Government

In 1951, Chinese forces attacked and badly routed the American forces in North Korea. A world war was imminent. In this regard, President Harry S. Truman indicated at a press conference that the use of the nuclear weapons was under consideration.[3] Furthermore, the loss of U.S. military personnel during the Korean War heightened the tensions between the United States and Communist China. In spring of 1951, with Truman's approval, nine atomic bombs were transferred from AEC control to the military for possible use on the Communist troops.[4] Luckily, U.S. government decided not to use atomic weapons against the Chinese troops. Later, in 1953, President Dwight Eisenhower gave his famous speech "Atoms for Peace" at the United Nations to expand the peaceful use of nuclear energy throughout the world for general welfare, increase the standard of living, encourage free competition, and promote peace. Under Truman, the nation's nuclear arsenal rose from almost no weapons to 1,600 by the time Eisenhower took office in 1953.[5] President Eisenhower preferred military men to dominate the AEC's extensive nuclear bureaucracy, and in 1953, he appointed retired general Kenneth Nicolls as the general manager of the AEC. Nicolls emphasized speed in the testing, production of atomic weapons, and deliverance to the military arsenal so that "we would be ahead of Russia…. The overriding consideration was a necessity to proceed faster with testing."[6] In 1958, the AEC ordered a series of nuclear bomb tests, anticipating that some limit would be placed on them before the end of the year because the Russians had announced a suspension of nuclear bomb testing. The two superpowers moved toward a voluntary suspension of nuclear bomb tests.[7] Due to extensive nuclear bomb testing by the AEC at

[3] Fradkin, *Fallout,* 92-93.
[4] Ibid., 94.
[5] Ibid., 111.
[6] Ibid., 122.
[7] Ibid., 133.

various testing sites, there was nuclear cloud/fallout in numerous surrounding areas, waterways, lakes, and hills. The AEC concentrated on the testing, front-end production, and delivery of atomic weapons, while there was no serious effort towards solving the backend issues of nuclear waste.

In October 1973, the Organization of Petroleum Exporting Countries (OPEC) proclaimed an oil embargo against Western countries that provided material and diplomatic support to Israel during the Yom Kippur War. As a result of the embargo, the prices of petroleum products rose significantly due to production cuts which caused a major economic crisis in the United States, furthermore, the petroleum products became scarce in the market causing loss of confidence and anxiety in American society. U.S. government considered various economic and energy theories to stabilize the U.S. oil market and to implement a long-term energy plan. President Richard Nixon introduced Project Independence, which required commercial nuclear energy production increased by 30 to 40 percent by the end of 1980s, and a further expansion to fifty percent by the twenty-first century. French Premier Jacques Chirac said in this regard that "For the immediate future, I mean for the coming ten years, nuclear energy is one of the main answers to our energy needs."[8] Later, in 1975, Energy Policy and Conservation Act was passed by the U.S. Congress which aimed to reduce U.S. dependence on petroleum and also improve air quality. The political leadership and nuclear industry insiders praised the executive and legislative initiatives in response to the oil embargo, while commercial energy producers were interested in initiating new projects to increase nuclear energy production. However, there were no serious discussions about what would happen to the high-level radioactive nuclear waste that would be generated once there is an increase in commercial nuclear energy production.

## U.S. Congress and Nuclear Technology

The U.S. Congress enacted the Atomic Energy Act (AEA) in 1954, which authorized the AEC to share technical and scientific information with Allied nations. Additionally, there was a possibility of having a commercial U.S. nuclear energy industry that would be licensed to have nuclear facilities. Then, they would need to establish safety regulations regarding nuclear materials for non-military atomic technology. Furthermore, the AEA encouraged certain exchanges of civilian nuclear technologies with friendly countries, and the American nuclear experts assisted them in building reactors for research and or production of electricity. Later, in 1974, due to oil crisis, the Energy Reorganization Act was enacted by the U.S. Congress, which got rid of the AEC, and in its place two new federal agencies were established, the Energy Research and Development Organization (ERDA) and the Nuclear Regulatory Commission (NRC). These agencies were created to control and regulate nuclear energy activities. However, in 1977, the ERDA was abolished, and the newly created Department of Energy (DOE) assumed their responsibilities, which included the development and production of nuclear weapons, promotion of nuclear power, and other nuclear energy related matters. While

[8] Robert Stobaugh & Daniel Yergin, *Energy Future: Report of The Energy Project At The Harvard Business School* (New York: Vintage Books, 1983), 134.

the NRC took over all regulatory functions, and all defense facilities were exempt from any civilian regulations.

The U.S. nuclear power operators and proponents developed a cavalier attitude towards the nuclear power critics as the "outsiders" and most decisions were made in private meetings, so there was no impediment in front-end production. The critics point to the lack of public scrutiny in U.S. government policies citing documents that support their case that concealment and distortion did in fact occur.[9] U.S. government's planning and resources were focused on the front-end procurement of nuclear materials and production of the nuclear weapons. Earlier, the AEC and later, NRC did not implement the same rules and regulations for commercial and defense nuclear waste programs. Many experts became concerned for the future of nuclear research, medicine, and cancer treatments which could stop if a disposal site for the RNW is not established.[10] It should, however, be noted that the high-level nuclear waste had become a major source of concern which overshadowed the future of nuclear power/technology in the country.

## Establishment of NRTS & Achievements

In 1949, the AEC decided to establish Nuclear Reactor Testing Station (NRTS) in the high-desert of Eastern-Idaho, about forty miles west of the City of Idaho Falls. Today, it is known as the Idaho National Laboratory (INL). Initially, the Department of Defense (DOD) through the Bureau of Ordnance used some 230 acres as the Naval Proving Ground for major caliber navy guns, and its isolated location was suitable for secure experimentation during the Second World War. Later, after the establishment of the INL, a variety of nuclear reactors were built and tested there, it is known that fifty-two have been built inside the complex over the years which is the largest concentration of nuclear reactors in the world. Due to its expansive desert location, the AEC saw great potential in the INL location as a hub of innovations in nuclear energy and other technologies, where they would build, test, and operate variety of nuclear reactors, fuel processing plants, and nuclear waste facilities.[11] Once the decision was finalized to establish NRTS (INL), the AEC took over the Naval Proving Ground and expanded the site to 890-square-miles that would house a variety of defense and civilian major projects, however, it would not be classified as a weapons manufacturing facility.

Later, the INL would be the crown jewel of the AEC's many national laboratories, which would be utilized as a multi-layered technological site, specializing in establishing, testing, and decommissioning multiple nuclear reactors. The INL complex required a steady source of water, paved roads, electricity, and skilled and non-skilled manpower, which the AEC procured through the State of Idaho. In addition, the AEC committed $500 million worth of resources for the establishment of various buildings, reactors, testing facilities, and related infrastructure at the INL. In the end, the AEC ended up

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[9] Stobaugh, *Energy Future*, 150-151.
[10] Gerald Jacob, *Site Unseen: The Politics of Siting a Nuclear Waste Repository* (Pittsburgh: University of Pittsburgh Press, 1990), xii – xiii.
[11] Susan M. Stacy, *Proving the Principle* (Idaho Operations Office of the Department of Energy: Idaho Falls, Idaho, 1996), 13.

spending $1,141,000 for the road from Idaho Falls, while the State of Idaho's share was $337,000 and a promise to improve the road from the Blackfoot Reservation. The Federal Bureau of Public Roads contributed another $563,000. Since the AEC wanted to have the road ready for service by the end of summer 1950, it was proposed to have the bids approvals by the winter of 1949, and hire various contractors who would finish a section of the project. By early 1953, a new road was extended to west of Rexburg towards Mud Lake area and other improvements to the roads connecting Idaho Falls, Blackfoot, and Arco.[12] By the end of 1950, there were about 1,100 people employed directly by the AEC or contractors/vendors providing variety of services at the INL.

The INL site is located on the ancestral homelands of the Shoshone and Bannock tribes. This expansive territory built the tribal economy through ample hunting and gathering opportunities while there is other sustenance also available such as salmon, fruits, and marine life. The Snake River Plain runs across the Site, starting from the north in the Yellowstone region in Wyoming, moving through the southern and western Idaho grasslands, and ending up in the Columbia River. The desert is hot in summer and unthinkably cold in the winter. The Snake River Plain is rich in roots, camas, tules, grasses, hawks, and eagles. The tribal communities used to hunt bison and used its flesh and bone for food, tools, and clothing.[13] According to Kristin Iversen, an American scholar, the INL sits six hundred feet on top of the Snake River Aquifer, the site is in an earthquake zone and a floodplain. This dump site is not safe, as it is one of the largest groundwater resources in the country and it serves many farming and residential communities while providing fresh water for many commercial entities.[14] Plus, it is the primary source of fresh water for over 290,000 people in the Southern Idaho. The majority of water in the Snake River Aquifer comes from rain and the melting snow from various tributaries near the eastern mountains in Idaho and Utah. The Snake River forms a forty-mile-long canyon wall that has many waterfalls shooting out of solid rock cliffs. The Snake River Aquifer starts from the border of Wyoming state border and runs through the eastern, southern, and part of western Idaho, and it is estimated that 7.5-million-acre feet of water pours through the Snake River Aquifer. Now, it is easy for us to understand the importance of the Snake River Aquifer for Idaho's agriculture, manufacturing, commercial industries, and drinking water. Most Idaho residents agree that the Snake River Aquifer is not only vital to the economy of the State, but also the marine life, the eco-system, and the lives of human beings.

[12] Stacy, *Proving the Principle*, 42-43.
[13] Ibid., 6.
[14] Kristin Iversen, *Full Body Burden: Growing Up in the Nuclear Shadow of Rocky Flats* (New York: Random House, Inc., 2013), 195.

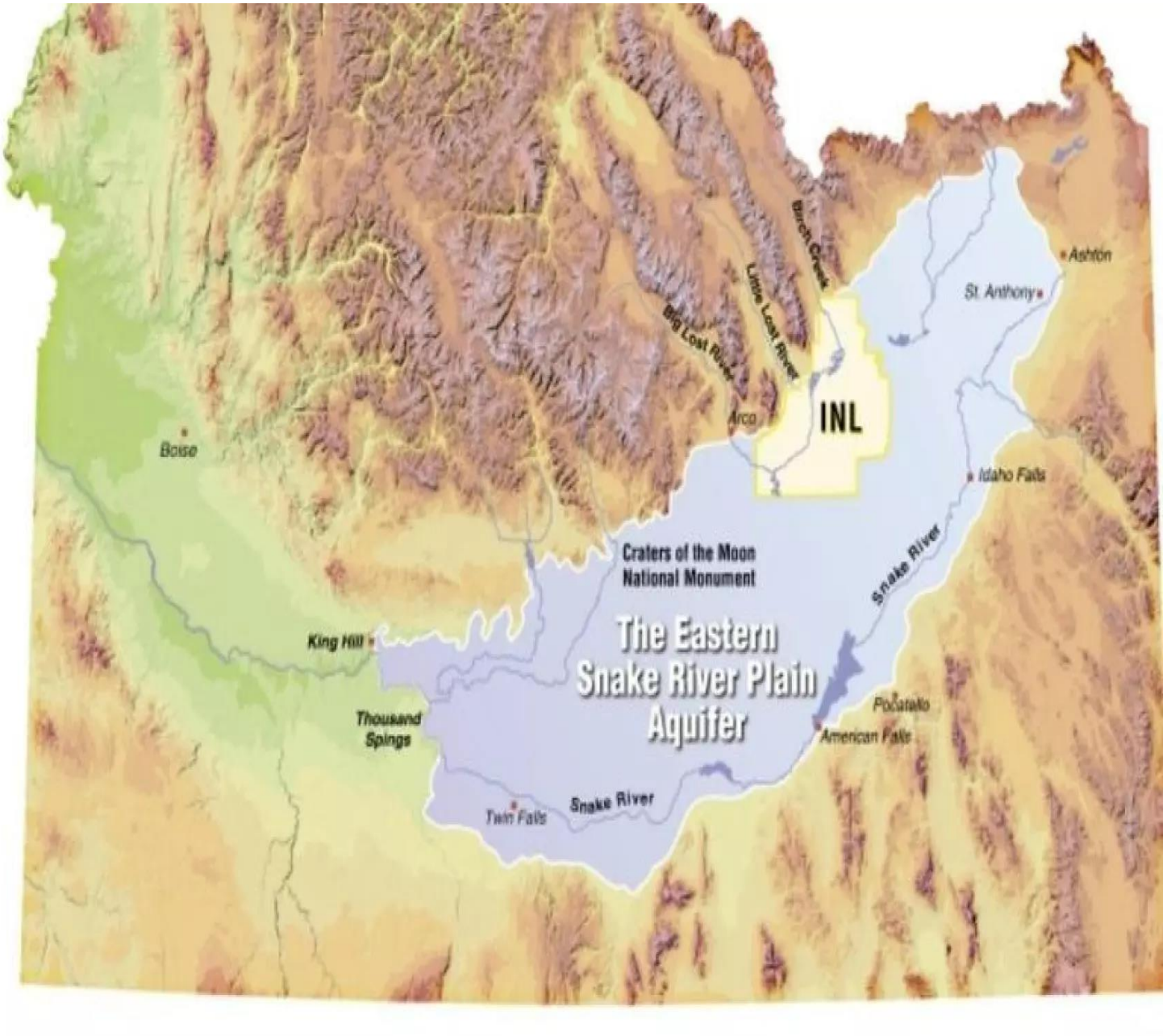


Figure 1.2 - The Eastern Snake River Plain Aquifer
Rachel Cohen, "Five Years After Water Rights Agreement, Idaho's Largest Aquifer is Improving," Boise State Public Radio News, Published July 13, 2020, https://www.boisestatepublicradio.org/news/2020-07-13/five-years-after-water-rights-agreement-idahos-largest-aquifer-is-improving

The INL was not designed to be a weapons factory, however, it has played an important role in nuclear research, reactor formulation and testing, and the development of new technologies relevant to U.S. defense, economic growth, and technological advantage during the Cold War. In the 1950s, the U.S. government invested millions of dollars at the INL for the development of


Figure 1.3 - Image by Jack M. Holl. *The National Reactor Testing Station.* The Northwest Quarterly Vol. 85, No. 1, The Nuclear Northwest (Jan., 1994), pp.15-24. Published by: University of Washington. Published on July 07, 2022, https://www.jstor.org/stable/40491427

various military and research projects that could have commercial implications. This in mind, the commercial utilities campaigned the U.S. Congress to authorize nuclear energy for commercial civilian use in the urban areas with the help of the U.S. government, once it was attained and available for commercial usage. In this regard, Susan M. Stacy, an American author and historian opined that “After the war, all the scientists had proven was that they could blow up a bomb,” she continues, “They had not proven that a nuclear reactor could be controlled and managed for the constant, safe output of electricity. They

were just to too far from that."[15] Furthermore, Stacy describes nuclear reactor as a machine that produces neutrons and makes heat, it is the design of the reactor that describes what kind of work or research the neutrons or heat are expected to perform.[16] Although, the INL engineers faced numerous technological hurdles but they were confident in developing electicity from the nuclear energy. The potential of nuclear energy to bring cheap, clean and in abundant quantity was realized on December 20th 1951, when the Experimental Breeder Reactor I successfully lit four light-bulbs from energy source of U-235 fuel, and within a few days it provided electricity for the entire EBR complex.[17] This was a monumental achievement by the INL engineers, as it demonstrated for the first time that the usable amount of electricity could be generated through nuclear technology, and later this innovation paved the path for future commercial energy source and nuclear industry.

## The Nuclear Fuel Cycle and the Wastes

The INL had been established to test the new breed of nuclear reactors which included variations in size, different nuclear fuels, and the production synthesization. However, one thing that was common before and after the reactor opeartions at the INL that they produced varying classes and shapes of radioactive nuclear waste (RNW). The back end waste operations are not limited to storage and disposal systems which are not entirely independent to those at the front end fuel cycle. Over the years, many fuel cycles have been used both at the front end and at the back end, however, the standard nuclear fuel cycle for research purposes is as follows:

. Mining the uranium ore,

. Milling the ore to obtain a uranium concentrate,

. Converting the uranium concentrate into a chemical form suitable for enrichment,

. Enriching the fissile material abundance in the uranium concentrate to degree required for reactor fuel,

. Converting the material to a chemical form suitable for fuel fabrication,

. fabricating nuclear power plant fuel,

. using the fuel in a nuclear power plant,

. storing the spent fuel at the nuclear power plant site,

. reprocessing the spent fuel to recover plutonium and uranium,

. recycling the recovered plutonium and uranium into additional nuclear power plant fuel, and

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[15] William McKeown, *Idaho Falls: The Untold Story of America's First Nuclear Accident* (ECW: Toronto, 2003), 40.
[16] Stacy, *Proving the Principle*, 44.
[17] Ibid., 64.

**.** disposing of the high-level radioactive wastes.[18]

Since its inception, many innovations have been achieved at the INL, and hundreds of patents for various technologies and energy sources are a proof of their technological ingenuity being used by the U.S. defense and private commercial entities. One of the most prominent innovations was the successful launch of the *USS Nautilaus* on January 21, 1954, which is the first nuclear energy-powered-submarine in the U.S. fleet capable of prolonged submersion, rather than a short one, and it travelled beneath the ice in the North Pole.[19] The *USS Nautilus* travelled from the Pacific ocean to the Atlantic ocean because it could stay submerged for months at a time, whereas, diesel-electric operated submarines could not travel under the ice freely due to endurance problems. According to naval experts, this protracted submersion was an engineering excellence of its time. Although there have been many important technological innovations at the INL, some projects were discarded after investing considerable amount of federal resources, engineers' time and labor. One of the abandoned project was the Aircraft Nuclear Propulsion Program (ANP) that would have produced a nuclear-powered-aircraft operated by nuclear energy. The ANP project brought about a thousand new jobs to the INL due to the infusion of considerable amount of federal resources. The Lexington Report estimated that $1 billion had been spent on new runway, specialized hanger, custom-made equipment and other facilities, but nuclear-powered-airplane never materialized. In 1961, President John F. Kennedy canceled the entire nuclear-powered-airplane project, saying, "the possibility of a militarily useful aircraft in the foreseeable future is still remote…"[20] Due to the cancellation of the ANP project, the Idaho State Governor Robert Symlie wrote to President Kennedy that the loss of ANP's 500 jobs would be a blow to Idaho of "disastrous proportions" and asked for some replacement research project that would keep the jobs in Idaho.[21] Many families were going to lose their homes that had moved into recently, however, within a few months the federal government came up with a replacement research program that saved most of the jobs in eastern Idaho. Early on it became clear that the economic stimulus generated by the INL through federal resources created high-tech and various other jobs in eastern Idaho, and it had become a major source of employment and economic-boaster for many rural communities.

## Definitions of RNW by the AEC

What is radioactive nuclear waste? There are hundreds of forms of RNW due to variations in materials, synthesizing, processing, purifying, enhancing, and other specific modulations. This amplifies the issue of categorizing these materials into a single category or a field.[22] In 1957, Carroll L. Wilson, AEC's general manager announced the first definition of High-level Waste as the material that "emitted radiation so strong as to

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[18] David A. Lochbaum, *Nuclear Waste Disposal Crisis* (Tulsa, Oklahoma: PennWell Books, 1996), 23-24.
[19] Ibid., 72.
[20] Ibid., 118-126.
[21] Ibid., 126.
[22] Luther J. Carter, *Nuclear Imperatives and Public Trust: Dealing with Radioactive Waste* (Washington, D.C.: Resources for the Future, Inc., 1987), 14.

materially reduce the time a person can be near the radiating body."[23] The evolution of definition of the high-level waste continued due to nuclear and energy research and innovations. Ten years later, the definition evolved to "material which, by virtue of its radiological concentration, half-life, and biological significance, requires perpetual isolation from the biosphere."[24] Later, in 1970, the AEC adopted a new definition of nuclear waste as everything from the extraction of raw materials to processed nuclear products and materials, and everything involved in that process.[25] This broadened definition of RNW by the AEC revealed the growing complexity of nuclear technology, which required more active participation by U.S. government in the implementation of comprehensive policies to permanently secure them. materials into a single category or a field.[26]

In 1970, the AEC recognized four categories of RNW: Low-level RNW comes primarily from nuclear reactor operations consisting of core and cooling system/materials, and other RNW products including tools, clothing, glassware, and the piping that makes up the cooling circuit.[27] Low-level Waste is considered the least irradiated nuclear waste in comparison with other categories. However, Carol Mongerson of West Valley Coalition disagrees with this assessment of low-level RNW, she states that "Low-level nuclear waste is a misleading term. West Valley has low level waste that is so radioactive it has to be driven in shielded trucks….They will tell you that in one hundred years all the radioactivity will be gone; that's not true."[28] While the High-level Waste is the most hazardous category because it produces fatal doses of radiation in a very short period of time due to its nature of origination, which is essentially the spent fuel of nuclear reactors. Fuel discharged from the nuclear reactor is reprocessed to recover uranium and plutonium by chemical dissolution and treatment.[29] Transuranic Waste is neither in the category of low-level or the high-level, yet it is highly dangerous due to the fact that it contains alpha-emitting plutonium, one of the most toxic elements in the nuclear fuel cycle, which has an extraordinary long life of 24,360 years.[30] The Decommissioned Waste is the fourth category which comprises of old buildings, equipment, concrete, and other materials from the decommissioned nuclear reactors. All of the nuclear waste forms can be further distributed into gaseous, liquid, and solid waste types. In this regard, Carter notes that "Radioactive wastes arise in every part of the nuclear power program from reactor operations to the running of reprocessing plants and other fuel cycle facilities. They arise in the facilities devoted to waste management

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[23] Office of Technology Assessment. "Managing the Nation's Commercial High-Level Radioactive Waste." U.S. Congress, OTA-O-171, Washington, D.C.: March 1985. Accessed 05 June 2022. 204.
[24] Ibid., 204; this is the definition of High-Level nuclear waste.
[25] Ibid., 205.
[26] Carter, *Nuclear Imperatives and Public Trust,* 14.
[27] Ibid., 18.
[28] Thomas V. Peterson, *Linked Arms: A Rural Community Resists Nuclear Waste* (Albany: State University of New York Press, 1990), 9.
[29] By Frank Pitman, United States Atomic Energy Commission, 'High-Level Radioactive Waste Management Alternatives,' Division of Waste Management and Transportation, WASH-1297, Distribution Category UC-70, May 1974, 3.
[30] Carter, *Nuclear Imperatives and Public Trust,* 2.

themselves."[31] Due to the possession of contaminating radioactive elements, all varieties of RNW are considered toxic substances that can pollute the environment and land, contaminate water, and cause severe harm to living beings, even death. However, in 1975, the Joint Committee on Atomic Energy (JCAE) broaden the scope of wastes produced by operation of the following fuel cycle facilities, such as the nuclear reactors, storage basins for spent fuel elements, reprocessing plants, and mixed oxide fuel fabrication plants, and they defined six basic types of commercial RNW:

1- **Spent Fuel**: Fuel-bearing materials and associated hardware as they exist after removal from the reactor prior to any reprocessing.
2- **Cladding Hulls**: Fuel element cladding segments and associated hardware segregated from spent fuel prior to reprocessing.
3- **High-level Waste**: The fission product waste resulting from reprocessing to separate uranium and plutonium from the fission products.
4- **Transuranic Waste**: Any waste material measured or assumed to contain more than a specified concentration (e.g., 10 nanocuries of alpha emitters per gram of waste) of transuranic elements (i.e., elements with mass number larger than 92).
5- **Non-Transuranic Waste**: Any waste material containing transuranic elements in concentration lower than that which designates transuranic waste.
6- **Non-Nuclear Waste**: Any waste material in which concentrations of all radiation-emitting isotopes are negligible.[32]

The defense nuclear waste storage, packaging, and disposal policies and practices do not come under the commercial RNW guidelines and categories, and their waste volumes or distribution methods are not shared in the public domain by the U.S. government agencies. However, there are uncertainties in the commercial nuclear power that are related to the changes in political, social, and economic atmosphere, which could create perceptions about the efficacy and longevity of nuclear power. More specifically, the spent fuel cycle of the commercial nuclear power plant operations are generating large volumes of high-level waste through the back-end waste operations that are being stored in temporary storage, while the irradiated fuel waste is being reprocessed to exrtract fissionable materials, and the final stage of the fuel cycle is the disposal of the spent-fuel or the high-level waste into a permanent repository.[33] The U.S. nuclear program/technolgy evolved from a purely military program in the 1940s into a commercial nuclear power generation in the 1950s. However, the mechanisms and policies of nuclear safety and regulations were held under the AEC umbrella, which played the role of a safety administrator and the administrator of nuclear weapons production. Donald Barlett, an American journalist noted that radioactive waste is being

[31] Ibid., 10.
[32] Hearings Before The Joint Committee On Atomic Energy, Congress of The United States, *Storage And Disposal Of Radioactive Waste,* November 19, 1975. U.S. Government Printing Office: Washington, D.C., 1975. #24 (p. 8 – 9).
[33] Gene L. Rochlin, *Plutonium, Power, and Politics: International Arrangements for the Disposition of Spent Nuclear Fuel* (Berkeley, University of California Press, 1979), 12.

held in “temporary” facility, just as it was in 1945. Furthermore, no one knows, how much there is. And no one-despite all claims to the contrary-knows what to do with it.[34] Defense waste is one of the most controversal issue that the AEC has tried to facilitate without disclosing details about it.

## U.S. Government Focused on the Front-End Production

Many industry experts predicted that large-scale production of nuclear weapons, nuclear energy, and medical services would create huge volumes of RNW that would be radioactive for hundreds maybe thousands of years. Robert Hershey, a *New York Times* reporter, noted: "until mid-1970s, the Government and the [nuclear] industry concentrated on building new reactors, assuming that waste would be taken care of," additionally, “there is still some controversy as to whether the scientific means exist to dispose safely of highly radioactive waste that can remain dangerous for hundreds, perhaps thousands, of years.”[35] The lack of efficient nuclear waste storage and disposal sites has become an unsolvable problem for policymakers because the radioactivity starts at the source of origination, and it does not end at the place where they are being stored and disposed. The INL spent fuel processing plant dumped 5.4 million pounds of chemicals into the Snake River Aquifer last year. Idaho Governor called for a halt to the radioactive, chemical, and sewage discharges into the Snake River Aquifer. The Governor’s Task Force recommended the recycling system, which would be the best option because wastes would be reprocessed emitting least amount of radioactivity in the environment. Jerry Ritter, a manager of technical operations for Exxon Nuclear Idaho Co. Inc. replied that recycling system would cost “tens of million of dollars,” and could take upto 10 years to build. Governor Evans responded that it is unacceptable to continue the discharges for three to ten years.[36] Senator Frank Church said in this regard that DOE should “put a stop to these discharges, once and for all” furthermore that “My primary concern is the long range cumulative effects.”[37]

Although the RNW policies were not being practiced perfectly at the INL, however, their technological enguinuity was starting to produce results. In 1951, at the INL four light-bulbs were lit from an generator connected to the Experimental Breeder Reactor-I and it generated reusable electricity that became the catalyst for a viable commercial nuclear energy industry (see figure 1.4). In a few decades, due to the rapid expansion of nuclear energy, commercial RNW would be greater in volume than the defense waste, and it is mostly high-level RNW, which emits radioactivity at a much

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[34] Donald L. Barlett and James B. Steele, *Forevermore: Nuclear Waste in America* (New York: W.W. Norton & Company, 1985), 20.
[35] *New York Times*, 25 January 1981.
[36] Rod Gramer and Lonnie Rosenwald, INEL studied waste-dump options, *Idaho Statesman*, December 15, 1979.
[37] Lonnie Rosenwald, Sen. Church urges end to discharges at INEL, *The Idaho Statesman*, December 13, 1979.

stronger rate than the low-level RNW. Although you cannot see the radiation, smell it or taste it, but it is spreading across the American landscape.


Figure 1.4 (Four Light-Bulbs are Lit)
Courtesy of the Idaho National Laboratory Historical Archives.
Experimental Breeder Reactor-I, December 20, 1951,

In 1950, waste from commercial use of the atom was counted in ounces. Today, it is counted in tons.[38] By the mid 1950s, the American society was swept up in the atomic frenzy; manufacturers, farmers, airplane manufacturers and other businesses were lobbying the U.S. Congress to develop the atom specifically to their particular needs and requirements. The electric utilities were utilizing more atomic power to produce energy and they were producing more waste. In December 1983, seventy-four reactors in twenty-five states generated a record 26.4 billion kilowatt hours of electricity, and with it a record 600 million curies of waste.[39] Many industry insiders were excessively optimistic about the nuclear energy being a major source of energy for the American communities. In this regard, Lewis L. Strauss, AEC chairman from 1953 to 1958, declared that "our children will enjoy in their homes electrical energy too cheap to meter."[40] This idealistic optimism in the American society regarding the efficacy of atomic energy created unrealistic expectations in the production of energy, products, and their cost.

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[38] Donald L. Barlett and James B. Steele, *Forevermore: Nuclear Waste in America* (New York: W.W. Norton & Company, 1985), 20.
[39] Barlett, *Forevermore*, 21.
[40] Ibid., 29.

The federal government encouraged the growth of the commercial atomic energy within the United States and formulated treaties with other countries to share peaceful nuclear technology. In August 1958, the Euratom Cooperation Act was signed by President Dwight Eisenhower following its passage through the Senate and House, authorizing formal cooperation between the U.S. Atomic Energy Commission and the Executive branch of the European Atomic Energy Community (EURATOM) establishing a Joint Atomic Energy Program. The EURATOM Treaty between the United States of America and the European Atomic Energy Community was signed at Brussels on Novemeber 8, 1958 that authorized to bring in large-scale power plants using nuclear reactors of types on which research and development have been carried to an advanced stage in the United States. Approximately total installed capacity of one million kilowatts of electricity would be provided by December 31, 1963, and an approximate amount of $215,000,000 would be provided by the local utilities and other European sources of capital. In this regard, a long-term line of credit for the amount of $315,000,000 would be provided by the United States to the European Community. In addition, U.S. government would also deal with plutonium recycling and other problems relevant to these reactors.[41] This expansive agreement by the U.S. government provided nuclear-energy-expertise, materials and financial assistance to various European countries in building nuclear reactors to generate commercial energy on a mass scale.

Also, the EURATOM Treaty authorized the United States to take full responsibility of the disposal of the RNW generated by the nuclear reactors in Europe. Initially, eight nuclear reactors were planned for six Euratom countries under the Euratom Act of 1958, which would have had maximum installed nuclear power capacity by 1965 in the region of 3.5 to 4 thousand megawatts. Another 25 research reactors were under various phases of planning, design, and construction needs and requirements.The U.S. government was able and ready to provide and support fuel supplies, the uranium output to the six Euratom countries is less than 700 metric tons a year, compared with 8,000 tons a year in the United States and a probable output of 10,000 to 15,000 tons per year by 1960 in Canada. U.S. sources are confident that the current uranium output is expected to increase greatly, as the uranium mining projects in the Western states start full production. Furthermore, the European Community has access to large reserves which will reduce import needs as production increases.[42] The original members of the EURATOM Treaty alongwith the United States of America were Belgium, France, West Germany, Luxembourg, and the Netherlands. However, later, most of the friendly European Union members were included into the agreement.

## Hazards of the RNW to the Environment and Life

[41] Hearings Before the Subcommittee on Legislation of the Joint Committee on Atomic Energy: Congress Of The United States, *AEC Omnibus Bills For 1963 And 1964*, July 17, 1963, U.S. Government Printing Office, Washington, D.C., 1964. 49-50.

[42] Bulletin From The European Community, *EURATOM Commission's Report on Community's Nuclear Industries*, Information Service, 220 Southern Building., Washington 5, D.C., August-September 1958/NO.31.

It has been known for sometimes that radioactive nuclear waste is hazardous and dangerous because it emits radioactive particles, which could be a risk to human health and the environment if it is not treated with care and its isolation is not properly managed. Madam Marie Curie, the recipient of two Nobel Prizes; first, she discovered radioactivity alongwith her husband, and second, she isolated pure radium in 1911. However, in 1934, she died of radiation-induced leukemia, which is considered one of the diseases associated with radioactive nuclear cancerous growths. A co-worker said in this regard that "She was very anemic and yellowish looking," and "she had some burns on her hands and her skin was very rough."[43] Maybe Curie underestimated the hazards radioactivity posed to her health. Furthermore, by the end of the Second World War many resources were employed to understand the effects of radioactivity on the human beings, environment and water. However, the Cold War pressures made people look away from safety concerns and standards. In 1979, Louis Hempelmann, Director of the Health Group at Los Alamos site of the Manhattan Project admitted in a sworn deposition that the contamination grew so severe that "if it had not been that we had to get the bomb made as soon as possible, all work would have stopped."[44] Due to lack of safety measures the plutonium quickly spread beyond the confines of the technical area. But most of the plutonium that slipped beyond the site came from the lab's waste water, which intially was dumped into the streams and canyons that angled down from the mesa. Los Alamos and Pueblo creeks were crackling with radioactivity.[45] By 1945, medical experts realized that plutonium in larger amounts could actually be more hazardous than radium. In this regard, Kristin Iversen, an author and a worker at the Rocky Flats Weapons Facility in Colorado describes the lethal and contaminating nature of plutonium: "[It] is a radioactive imp. It flares and burns unpredictably. Like a lethal bee flying from flower to flower, plutonium taints everything it touches. What becomes contaminated with plutonium becomes contaminating itself."[46] The bees polinate various trees and orchards to enhence their production, while the RNW is the end-result of the production. The RNW materials can remain radioactive and dangerous to the human beings, environment and marine life for hundreds maybe thousands of years.

The Snake River Aquifer is the largest underground freshwater resource for over 290,000 residents and farming communities in Idaho, and a thought of it getting contaminated by the RNW stored at the INL makes Idahoans very nervous and angry. In late 1960s, Robert A. Erkins, president of the Snake River Trout Company wrote a letter to Governor Don M. Samuelson, expressing concern about the Snake River Aquifer, which feeds the springs that support the state's trout farming industry, might become polluted with the RNW stored six hundred feet above it.[47] Erkins had been alarmed by an *New York Times* article that broke the news about hundreds of railroad cars carrying high-level RNW from the Rocky Flats to the INL to be buried below ground, while the Snake

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[43] Eileen Welsome, *The Plutonium Files: America's Secret Medical Experiments in the Cold War* (The Dial Press: New York, 1999), 61.
[44] Welsome, *The Plutonium Files*, 76.
[45] Ibid., 76-77.
[46] Kristin Iversen, *Full Body Burden: Growing up in the Shadows of Rocky Flats* (New York: Crown Publishers, 2012), 194.
[47] H. Peter Metzger, *The Atomic Establishment* (Simon and Schuster: New York, 1972), 150.

River Aquifer separated by the layer of basalt rock that was only six hundred feet from the surface. In this regard, the National Academy of Sciences (NAS) as a early as 1955 concluded that "continuing disposal of low-level waste … above the water table, probably involves *unacceptable* long term risks," and in 1960 the NAS committee said: "No existing AEC installation is in a geologically acceptable location for disposal of highly radioactive liquid waste …" later in 1965, it went even further: "… *none of the major sites* at which radioactive wastes are being stored or disposed of is geologically suited for safe disposal of *any manner of radioactive wastes* other than very dilute, very low-level liquids."[48] The public release of the NAS report caused the AEC to announce the removal of the buried RNW at the INL to a permanent repository outside of State of Idaho. However, as the large volumes of high-level RNW from the Rocky Flats facility became a environmental issue for Idaho, while the AEC was having trouble finding a geologic repository site, since no State wanted it in their territories.

In the 1950s, the nuclear waste tailing piles posed a significant hazard to the environment and marine life as they were scattered across the Colorado River Basin, numerous uranium mines, processing and other storage facilities. U.S. Public Health Service in the late 1950s asked for a fish sample to be collected from the Animas River downstream from the AEC-licensed uranium mill at Durango, Colorado. Later, their report revealed that they did not find any fish and no life at all; what was described as a "biological desert."[49] Even with such a shocking finding, the AEC saw no immediate health hazard to the human beings living near the river. Around the same time, uranium miners had been asking the AEC to review long-term hazards posed by mining conditions, tailing piles, and unlined ponds with assorted amounts and qualities of nuclear waste. Jesse Johnson, the director of the AEC's Division of Raw Materials, said, "There are some natural water supplies both in this country and in Europe that have a similarly high radium content. These have been used for years as a source of domestic water."[50] The AEC played down the seriousness of the hazards posed to the human beings by the leaked RNW in the environment, water, and storing facilities. However, the residents of Idaho understood the hazards posed to the Snake River Aquifer by RNW at the INL, and they wanted to have them removed to a permanent repository outside of the State of Idaho.

As mentioned earlier that there are many forms of RNW, and some liquid forms are stored in waste-water trenches near the uranium mine waste-storage, processing and manufacturing facilities. In the case of Hanford Reservation, Washington there are reports confirming that ducks were feeding on the algae grown in waste-water trenches that was so radioactive that they "would have given a person five times the maximum permissable dosage of radiation if eaten."[51] According to Metzger, the Columbia River and its tributories are considered one of the most contaminated in the world due to large quantities of high-level RNW, specifically plutonium from the leaking storage tanks at the Hanford Reservation. It also public knowledge that the Indian tribes have been

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[48] Metzger, *The Atomic Establishment*, 153-154.
[49] Ibid., 162.
[50] Ibid., 165.
[51] Ibid., 154.

protesting against the RNW contamination of the Columbia River for decades, as they are facing the consequences in the form of a severe decline in the salmon species in the river, which has effected their livelihood, fishing industry, and recreational activities. The Idaho residents became more apprehensive about the RNW at the INL, as news from around the country about numerous nuclear waste accidents, cleanup disasters, nuclear waste leakages and contamination of water became more focused.

## Idaho: A Land of Natural and Manmade Disasters

The state of Idaho has a history of calamities that range from wildfires, flooding, earthquakes, a volcanic eruption, and a wide variety of manmade disasters. It is important to remember how climate, seismic activity, industrial and mining production, and lumber industries have created an environment where most of the Idaho residents are hesitant to allow business or government entities to expand their waste producing capacities that could be detrimental to their economy, environment, and water resources. It is understood that the state of Idaho was never adamant about enforcing safety measures or solving labor issues in various mines operations. In 1893, the office of Idaho State Mine Inspector was established with the responsibilities of protecting miners and promoting the mining industry. However, a series of individuals who were in charge of this entity only had the interests of the mining operations in mind. One inspector was a stockholder in Idaho mines, another one wanted to shorten the statute of limitations for mine accident compensation claims, while a third person ignored coroner's advice to visit the Bunker Hill mine to review conditions where three men had died in a mine cave-in accident.[52] Later in 1906, a mine-inspector said about a comprehensive safety legislation that "Our mining industry is as yet young and I do not believe in encumbering our statutes with too stringent provision, such as to discourage outsiders from developing our mineral resources."[53] Due to lack of comprehensive safety measures and facing extensive mining pollution, many people were discouraged to work at the Bunker Hill mines, thus causing a labor shortage. This unexpected slowdown of the mining operations caused the Idaho state legislators to pass a mine-safety law in 1909 that regulated underground mine operations and their equipment.[54] As a result, the Bunker Hill mine-management provided better safety and protection necessities for their workers, furthermore, they offered better living conditions by improving the social structure and environment for the mine workers and their families living in the vicinity of the mines.

The Idaho mine owners and their managers did not take any voluntary measures to reduce water pollution caused by large volumes of tailings and waste generated from various underground mine-operations. From the 1890s to 1960s the waste created by Mullan, Burke or Pine Creek mines were discharged directly into the South Fork of the Coeur d'Alene River. However, in the 1960s three federal water pollution control acts were approved that strengthen the federal government's enforcement powers for all navigable water bodies and it also increased federal support of state and interstate

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[52] Michael C. Mix*, Leaded: The Poisoning of Idaho's Silver Valley* (Corvallis: Oregon State University Press, 2016), 24.
[53] Mix, *Leaded: The Poisoning ,* 24.
[54] Ibid.

pollution control programs. Later in 1966, the passage of the Clean Water Restoration Act mandated states to establish their own water standards and plans for their implementation. The federal government had the right to intervene if the standards and plans were not completed as proscribed.[55] However, these water pollution control acts proved to be ineffective because the primary responsibility for the implementation of the programs rested with the states, and unfortunately, most of the states did not comply, including Idaho. Additionally, the federal government failed to act in accordance with the law by not insisting on enforcing improvements in the quality of water ways, implementing water treatment mechanisms in a satisfactory timeframe, and establishing structural organizations. As a result, the water pollution conditions in Coeur d'Alene River did not improve. A few years later, a water quality examination report of the Coeur d'Alene River stated that "The Bunker Hill operations at Kellogg and Smelterville were, by far, the largest source of metals being discharged into the South Fork."[56] It is not only the environment, water, and human beings that were being affected by the lead poisoning from the Bunker Hill smelter, but the animals on the ranches in the vicinity of the smelter also became ill and many died. In 1970, Dr. Roy Larson, a local veterinarian advised the Bunker Hill officials about the illnesses and death of horses near the smelter that were caused by heavy metals, and he told them to compensate the ranchers for their losses. Later, independent studies proved that pasture and forage at the nearby ranches contained 80 to 150 ppm lead that was toxic to horses.[57] The Bunker Hill paid modest amount of compensation to the ranchers for the illness and death of their horses. However, in 1974 Bunker Hill sent a letter to the ranchers near their facilities that their smelter has not discharged significant amounts of antimony in the soils of this area. Furthermore, the letter stated, "It is strongly recommended that you [ranchers] not allow the pasturing of livestock, and particularly horses, on your lands in this area."[58] Afterwards, the Bunker Hill administration refused to pay any more claims for horse deaths to the ranchers after that communique. In 1981, Bunker Hill mines were closed, however, their toxic legacy remains in the Silver Valley and mining districts in the western Idaho region, while many of the sites are part of the federal government's superfund, which means that these sites are contaminated with hazardous materials and chemicals which needs to be cleaned up for a long time.

The INL complex has a variety of radioactive and chemical waste sources that have disposed of large volumes of RNW which have reached the Snake River Aquifer. First, the wastewater streams are directed into disposal wells or percolation ponds, and second, the burying of wastes or above-ground leaks. In 1992, the practice of reprocessing spent fuel at the INL ceased at the Idaho Nuclear Technology and Engineering Center (INTEC) that discharged wastewater directly into the Snake River Aquifer from a 600 feet deep disposal well. Millions of gallons of wastewater, (nearly a million gallons a day, about 21,100 curies of tritium from 1953 to 1988), were disposed of. A Curie is one of three units used to measure the intensity of radioactivity in a sample

[55] Ibid., 68.
[56] Ibid., 70.
[57] Ibid., 115.
[58] Ibid., 116.

of material. Moreover, leakage from INTEC's high level RNW storage tank farm in 1972 contaminated soil and the Snake River Aquifer that included thousands of curies strontium-90 and cesium-137 and other radionuclides.[59] Initially, the public was not informed about the dumping of RNW directly into the Snake River Aquifer, but later on it was disclosed in a report in 1990 about the RNW contamination by the INTEC. Later, the disposal wells, unlined ponds, and wastewater dumping were discontinued in various sections of the INL complex. All contaminated areas/segments at the INL became high priority cleanup sites under CERCLA superfund remediation program. Interestingly, the retrieval of the buried RNW continues for the CERCLA cleanup at great expense and effort, but the DOE continues to bring in more RNW to the INL complex.[60] The INL administration has been concentrating their efforts on retrieval, packaging, and getting ready the transuranic RNW for permanent disposal at the WIPP. In addition, there are plans for additional buried waste at the INL complex at the Replacement Remote-Handled Low-Level waste facility at the ATRC. Although there are large quantities of RNW already at the RWMC, the proposal to bring in more low-level RNW will increase the level of anxiety of Idaho residents because the risk of contamination of the Snake River Aquifer increases with the higher volumes of buried RNW at the INL. Earlier, it was assumed that it would take thousands of years for the RNW to travel from the INL to the Snake River Aquifer, however, today, it is understood that it would only take about a hundred years or less.

The state of Idaho has experienced many natural disasters that have had significant impact on various manufacturing, production, and farming activities. The Idaho Statesman report on March 31, 2020, states that on October 28th, 1983, an earthquake measuring 6.5 magnitude shook the Mount Borah near the Challis area which was the strongest in Idaho history since 1935.[61] Mount Borah is approximately a hundred miles from the INL complex where thousands of tons of high-grade nuclear waste are stored for final disposal. Additionally, it is reported that between 1953 and 1974 the ICCP at the INL discharged 69 billion gallons of water contaminated with radioactive materials into the Snake River Aquifer. Sherri Chapman, former assistant director of the Idaho Water Resources Department said in this regard: "It stands to reason that if you have radioactive contamination, of whatever level, it won't be too far in the future when we are

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[59] Environmental Defense Institute, INL Contamination and the Snake River Plain Aquifer – The Essentials, US Geological Survey, An Update of Hydrologic Conditions and Distribution of Selected Constituents in Water,
Snake River Plant Aquifer and Perched Groundwater Zones, Idaho National Laboratory, Idaho, Emphasis 2006-08, DOE/ID-22212, Report 2010-5197, 2010. (and)
T. M. Beasley, P. R. Dixon, and L. J. Mann, "99Tc, 236U, and 237Np in the Snake River Plain Aquifer at the Idaho National Engineering and Environmental Laboratory," Environmental Science & Technology, 32:3875-3881, 1998.http://www.environmental-defense-institute.org, accessed 05/13/2023.

[60] Mark R. Arenaz, US Department of Energy, "Remediation of Buried Waste at the Idaho National Laboratory
Site," WM2010 Conference, March 7-11, 2010, Phoenix, AZ.
http://www.wmsym.org/archives/2010/pdfs/10065.pdf, accessed on 05/21/2023.

[61] The *Idaho Statesman*, Idaho has a history of earthquakes, and many share epicenter with Tuesday's 6.5 quake, posted on March 31st, 2020. Accessed on 05/23/2023.

going to damage the aquifer for agriculture."[62] In the same article, Bruce Peterson, the Idaho health official said that he was not aware of plutonium being discharged into the Snake River Aquifer. Peterson objects to the practice because of plutonium's long half-life that can be radioactive for 10,000 plus years. In addition, Idaho is the only state that has a large nuclear facility but lacks a strong radiation control program.

The filling of water in the newly built Teton Dam near Rexburg, Idaho was underway, on June 5th, 1976, some wet patches were noticed by the workers on the walls of the dam which meant that there was a leak within the wall of rocks. Then two leaks appeared near the abutment on the right side of the dam. While the repair work was being conducted, the dam collapsed creating a 280-foot waterfall, where almost 80 billion gallons of water rushed down the river, overflowing its banks and covering most of the flat lands, farms, buildings, and other structures in its path. There was widespread destruction: 11 people died, drowning 15,000 heads of livestock, and about $1 billion worth of damage had been reported.[63] The flood water gushed through the INL complex, luckily, the damage to the RNW pits and trenches was minimum. Nevertheless, it is hard to believe that the AEC did not think through the menace of burying high-level RNW in a major flood plain. Moreover, it is understood that there have been many heavy snowfalls in winter in Idaho, Utah, and Wyoming, which caused severe flooding in many areas including the INL complex. In this regard, Charles Zimmerman, a graduate student of Cornell University wrote to U.S. Senator Frank Church, stating: "As you observed in 1970, the AEC, like all government agencies, is created for the benefit and protection of the people, and should make public as much information as possible … the recent flood at Teton Dam has raised once more the question of whether the radioactive wastes buried at the [INL] are likely to enter the Snake River Aquifer."[64] Senator Church had been a vocal critic of the AEC's RNW storage and disposal policies, asked the AEC to remove all nuclear wastes from the INL to a permanent repository outside of the state of Idaho.

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[62] Rod Gramer, The *Idaho Statesman*, INEL plutonium detected in Snake River Aquifer, Boise, updated December 3rd, 1979.

[63] The Biggest Dam Failure in History – the Teton Dam, Idaho. The Amazing Teton Dam Disaster (Yellowstone region), https://www.rocdoctravel.com/2015/12/coming-soon-teton-dam.html, accessed on 05/19/2023.

[64] Teton Dam Flood," 15 June 1976, File 16, Box 54, Frank Church Papers, BSUA.

On May 18th, 1980, Mount St. Helens erupted sending a plume of ash, smoke, and debris high into the air that travelled across many parts of the states of Washington, Idaho, and Oregon. The Lewiston Tribune article Eruption turned day into night reported that the U.S. Geological

Figure 1.5 - Courtesy of Rexburg Historical Society, photo of Teton Dam by Mrs. Eunice Olson, 5 June 1976.

survey estimated about 540 million tons of ash from the mountain fell over an area of more than 22,000 square miles interrupting business, transportation, and education while erecting extraordinary challenges for Idaho residents and government officials. Although Mount St. Helens is located inside the state of Washington, the eruption brought ash and

debris to many communities inside the state of Idaho affecting many lives, environment, crops, and roads. Before the eruption, Mount St. Helens had been a picture-perfect scene of serenity and majestic beauty, but the massive ash and mud clouds created various gases and hot ash that changed the landscape. In this regard, Portland State University Geology professor Leonard Palmer stated that "The entire top of the mountain, of course, is blowing consistently, probably since about 8:30 this morning when the first eruptions occurred, and blowing about two miles above the crest of the mountain." The Mount St. Helens eruption changed the course of operations at the University of Idaho; the main campus was closed to all traffic so the ash on the ground wouldn't be kicked up by vehicles. Furthermore, Jerry Evans, the Idaho State Superintendent of Public Instruction, announced that the students wouldn't have to make up the days they had missed because most school districts had been closed for many weeks and the emergency closure declaration waived the attendance requirement. In addition, there was widespread damage to the timber industry in Northern Idaho where hot ambers had burned thousands of trees and damaged large segments of the forest floor. The Mount St. Helens eruption caused 57 deaths and more than a billion dollars' worth of damage to many communities, entities, and industries. Strangely, there are at least two Buttes within the INL complex, and many in Idaho, which means that there has been volcanic activity in the past, and there could be volcanic activity in the future.

In December 1958, the *Aviation Week* reported that the Soviet Union test flighted a nuclear-powered bomber about six months ago, and there were many observers inside and outside of the Soviet Union who had witnessed it on the ground and in the air. Probably, it was fake news because President Eisenhower said: "There is absolutely no intelligence to back up a report that Russia is flight-testing an atomic-powered airplane." However, President Eisenhower did not disclose that the U.S. government had been working on a Aircraft Nuclear Propulsion (ANP) project, which started in 1946 and ended in 1961, costing over one and a half billion dollars. This included a barrel-vaulted building (320 feet by 234 feet) that was built, along with a 23,000 feet long runway for the ANP project at the INL complex. At that time, the ANP project brought a substantial amount of growth to the INL and its surrounding communities. It was expected to have over a thousand people employed for the airplane station. However, the ANP project faced major technical issues, such as extremely high temperatures produced by the nuclear reactor that could not fit inside the airplane frame, while the crew could not be shielded from the nuclear radiation. In addition, there were significant logistical and administrative issues, such as, if a nuclear-powered airplane leaked fuel near or above civilian population or it crashed in populated city, then the insurance liability would be significant for the U.S. government. Later, in 1961, President John F. Kennedy cancelled the ANP project by stating that "the possibility of a militarily useful aircraft in the foreseeable future is still very remote…" The cancellation of the ANP project was a major financial blow to the state of Idaho. Idaho Governor Robert Smylie wrote a letter directly to President Kennedy urging him to reconsider his decision because Idaho would be losing 500 jobs connected with the ANP project or a replacement research project should be awarded to the INL. The counties and cities surrounding the INL complex had planned and invested in various housing projects, infrastructure, schools, and other amenities for the people and their families working at the INL. In this regard, Jay Kunze,

an ANP physicist and engineer at the INL said that "The company [GE] kept about a hundred of us in Idaho…and sent others to San Jose or GE facilities elsewhere." Later, significant research projects were awarded to the INL, which stimulated local economies in the surrounding six counties, and they did not fall on tough economic times, as the political leaders were assuming.

The most prominent critics of the ANP project were J. Robert Oppenheimer and Edward Teller, who did not endorse a nuclear-powered airplane that could fly indefinitely in the air due to various technical and logistics complications. On September 9, 1951, *New York Times* reported that the atomic airplane had great appeal, though the AEC made no secret that passengers in all probability would have to be exposed to some "acceptable" level of radiation. However, the Joint Committee was advised by the Office of Aircraft Nuclear Propulsion that the ground test of a propulsion system was possible around 1959 and further flights in 1960. While GE estimated that ANP project would require $2.5 billion for the program leading to and the delivery of 120 nuclear power plants for the first wing of 30 aircraft by 1964. The ANP project faced many technical, fiscal, and manageability issues that could not be rectified in a timely manner. Although the ANP project was shut down, the INL still has many important projects to their credit, such as the commercial nuclear energy, the USS Nautilus, and others. Later, all the aforementioned state, national and international events, programs, and policies will have a direct or indirect effect upon the storage, disposal, and retrieval policies of RNW at the INL.

In conclusion, this chapter introduced a brief history of atomic energy in the USA, and how the events during the WWII shaped the future of nuclear energy. The Cold War certainly had a major impact on U.S. nuclear policy and production/weaponization of nuclear materials. The AEC was created to manage the production of fissionable materials while establishing health and safety standards for nuclear industry. The INL was created by the AEC as a nuclear reactor testing complex in the eastern-Idaho desert due to its isolated location, and later, its technological prowess produced many useful projects, including commercial nuclear power. The AEC came up with the definition of RNW, however, the main problem they could not solve was finding comprehensive methods for storage and disposal of the high-grade RNW. Many different variations were formulated and tried at the INL to reduce the volumes of RNW, such as the calcinization of the RNW, formation of solid cement blocks to reduce the space, but the natural radioactive emiting properties could not be weakened into a short period of time. The U.S. Allies were counting on the U.S. nuclear program as a shield against the Soviet threat, which created an urgency to concentrate on the front-end production of nuclear weapons while ignoring the back-end storage and disposal problems of RNW. The Idaho residents were very concerned about the contamination of the Snake River Aquifer by the variety of RNW in the INL trenches, unlined ponds, and other reprocessing facilities because they did not have a comprehensive safety and vigilance program in place. The AEC had concentrated on the procurement and weaponization of nuclear fission materials, and since all their resources were focused on the front-end production, there was not a serious effort to have a comprehensive storage and disposal program in place.

## Key Points:

. The nuclear technology history (The Manhattan Project).

. The AEC is established in 1946 to promote and protect nuclear technology.

. The NRTS (INL) is established in 1949 in Idaho for atomic research and development.

. The INL sits on top of the Snake River Aquifer, which is a major source of fresh water.

. Many Idaho residents fear RNW contamination, while some feel adequate technology.

. The Cold War pressures push U.S. gov't into front-end production mode.

. The Atomic bureaucracy is considered aloof and exclusive without any public scrutiny.

. International pressure on U.S. government to provide a comprehensive nuclear security to its Western Allies against the Soviet threat. In 1954, AEA is signed in this regard.

. In 1973, Oil embargo is imposed by the OPEC, changing U.S. oil, energy, and security policies.

. In 1974, the ERA abolished the AEC, and replaced it with ERDA and NRC. Later, ERDA was abolished and it was replaced by the department of Energy.

. The AEC and later NRC did not implement rules for commercial and defense wastes because their priorities were focused on the front-end production.

. The NRTS (INL) established in 1949, U.S. government provided resources for all projects.

. Many technological inventions happened at the INL; commercial nuclear energy is one of them.

. In 1970, four categories of RNW were recognized by the AEC.

. The EURATOM Treaty signed in 1958, a comprehensive nuclear materials and waste program. Later, the INL became the nuclear dump for all international entities.

. Experts agree that the RNW posed hazards to the environment, water, marine life and humans.

. Many RNW accidents in the country proved the obstacles to the storage and disposal programs.

. Idaho is a land of natural and manmade disasters making RNW contamination probable.

. The INL complex has a variety of radioactive and chemical waste sources that have disposed of large volumes of RNW into the Snake River Aquifer.

. The Teton Dam collapse in 1976 brought gushing flood waters to the INL trenches and pits.

. The INL job cuts due to cancellation of ANP project impacted local economies negatively.

# Chapter 2

## U.S. Nuclear and Waste Policies

Towards the end of the Second World War, most nations suffered from a lack of military power, although many national efforts were made to achieve new defense resources and to innovate newer methods to utilize and deploy weapons or defense strategies. Additionally, several countries collaboratively developed defense programs and agreements. More specifically, the U.S. government demonstrated the destructive power of the atom by dropping two atomic bombs in 1945 on the Japanese cities of Hiroshima and Nagasaki while demanding unconditional surrender by Imperial Japan. Within several years, many defense experts feared that due to the technological transformations of the post-Second World War era, the international arena of war had changed immensely, which required the U.S. government to develop and further strengthen their defensive capabilities. Amplifying these concerns, General Dwight Eisenhower said in 1947 that, "Any aggressor nation seeking domination of the earth, must defeat the United States and must defeat us before we can achieve our maximum strength. Therefore, if global war comes to us again, the first blow will be struck not at Warsaw but Washington; not at London but at Los Angeles; not even at Pearl Harbor but at Pittsburgh."[65] In light of this bleak future scenario, the United States and its allies began looking for post-war strategies to secure their national safety and prosperity by developing a comprehensive nuclear weapons deterrent against non-ally countries, specifically the Soviets with whom some of those allied nations had entered into a Cold War soon after the end of the Second World War. The Cold War between the United States of America and the Soviet Union presented an existential threat to the mainland United States and Western civilization in general. After the Soviet Union detonated their first nuclear device in 1949 in a remote area of Kazakhstan, the U.S. government decided to adopt the policy of containment against the global spread of communism and ended trade and economic cooperation with the Soviet Union. Amidst this containment policy, anti-communist sentiment increased exponentially among American society and the allied nations. Concurrently, concerns about national security increased, and many U.S. political and military leaders demanded an increase in U.S. atomic capabilities in order to maintain a military superiority over the Soviet Union.

In 1949, William L. Borden, executive director of the Joint Committee and Senator McMahon wrote a letter to Secretary of Defense, Louis A. Johnson urging him to increase the production of atomic weapons because that was "the keystone of our military policy and a foundation pillar of our foreign policy as well."[66] Later, in 1951, the Joint Chiefs of Staff sought $5 billion for the expansion of uranium and plutonium production,

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[65] Henry A. Kissinger, *Nuclear Weapons and Foreign Policy* (New York: W. W. Norton & Company, 1969), 23.
[66] H. Peter Metzger, *The Atomic Establishment* (New York: Simon and Schuster, 1972), 49.

which was granted by President Harry Truman. The U.S. government was expanding the atomic energy program for the purpose of producing atomic weapons, an over-powering weapon that could help in standing against the Soviet Union aggression in case of a war. The European Allies were also looking towards the U.S. administration for security and protection against the spread of Communism and Soviet Union's hegemony. Chairman of the AEC, Thomas E. Murray cited a statement that appeared in the British White Paper on Defense in April 1957, states that "The Free World is today dependent for its protection upon the nuclear capacity of the United States."[67] The U.S. government, American society at large, and their Allies wanted a tested and proven security mechanism through nuclear weaponization that would deter and defeat the Communist threat of world domination. In this regard, Sarah Robey, professor of History of Nuclear Science & Technology at Idaho State University said that, "the Cold War created a fear of Communist doctrine in the American society; secondly, a constant threat of a devastating war with the Soviet Union that would wrought destruction to the mainland America, which gave rise to an aggressive thought against it across the country."[68] The Soviet threat hung over the United States like a dark cloud, and to counter this threat the AEC wanted to achieve higher levels of production of fissionable materials, and to achieve this goal they placed all their expertise and resources into front-end production.

## The AEC Structure

The AEC's main goal was the development, production, and control of nuclear technology/energy for defensive and civilian applications. Interestingly, they were also in-charge of the public safety and nuclear technology & guidelines. After its inception in 1946 through the implementation of the Atomic Energy Act, the AEC, the General Advisory Committee, the JCAE, and the nuclear power industry insiders exercised a complete monopoly over nuclear policies and programs for the first two decades. The aforementioned setup in American political and administrative system is considered a subgovernment model of policymaking. The subgovernment consists of midlevel executive agency bureaucrats, congressional committees or subcommittees, and the elite group interested in particular policy formulation and its implementation. Furthermore, it is understood that U.S. government does not shift economic, political, and military policies abruptly because they fear instability. Stability of the government policies is considered the cornerstone of American society; however, there are certain crisis and events that compel the government to devise and implement reforms. In this regard, Antonio Gramsci notes that, "The crisis consists precisely in the fact that the old is dying and the new cannot be born; in this interregnum a great variety of morbid symptoms appear."[69] Each client group under subgovernment policy-making benefits from the success of a project/program, their shared interests compel them to achieve consensus through quiet negotiations and compromises.

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[67] Thomas E. Murray, *Nuclear Policy for War And Peace* (New York: The World Publishing Company, 1960), 48.
[68] Sarah Robey, interview by author, Idaho State University, Pocatello, Idaho. 24th August 2022.
[69] Robert J. Duffy, *Nuclear Politics in America: A History and Theory of Government Regulation* (Lawrence: University Press of Kansas, 1997), 1.

Furthermore, gradualism is exercised to provide benefit to all participants because significant policy shifts could attract attention of the outsiders of the subgovernment, which could affect the autonomy of the client groups. The public participation in policy formulation is non-existent since most of the earlier projects had defense dimensions and national security was the top priority.[70] The subgovernment influence was dominated by a small group of people, who receive subsidies from the U.S. government along with other benefits for their entities and groups, and they preferred low public visibility for any negotiations. The policymaking is largely bipartisan and cooperative because the AEC, GAC, and JCAE were united in the goal of developing a self-sustaining atomic program. It is understood that the atomic program was essential in our 'national interest' and anything pertaining to nuclear power could be promoted under its umbrella.[71] Since subgovernment policy monopolies were running the AEC daily operations, it is assumed that their policies were reliable and persistent, and they will be able to adjust to external pressures. Under suitable conditions, the AEC policymaking process was conducted through robust discussions and negotiations, and all participants had a say in finalizing nuclear policies to ensure no policies were finalized in a political or administrative vacuum. However, in 1960s, the American society saw a significant change in government policymaking as a result of the American Civil Rights Movement, which brought about a major policy shift in housing, employment, consumer protection and other sectors. In addition, there is another major shift in political demographics in the country that requires an increased and more meaningful citizen participation in the political process. Anthony King, professor of Government Studies, states in this regard that, "it came to be thought good for both the participating individuals and the polity that ordinary men and women should have a direct say not merely in the choice of public office holders but in the making of public policy."[72] The public perception about the AEC functioning bodies is that they are extremely impersonal, and their officers are too far removed from the approach and understanding of an average citizen.

The AEC made ad-hoc decisions regarding the commercial nuclear reactors, storage, and disposal of RNW. Earlier, the environmentalists thought about nuclear energy as safe for the environment as compared to the coal generated power plants. However, their views changed drastically in 1967, when the heated water from a nuclear reactor was discharged into the Sandusky River in Ohio that resulted in killing over 300,000 fish.[73] Thermal pollution became more pronounced with larger nuclear reactors with short-term and long-term effects on different marine species as the water temperature changed ten to twenty degrees. However, the AEC did not respond well to the concerns of safety of environment, soil, water, and marine life because their main objective was to encourage the development and use of nuclear power. Environmental concerns were considered distraction from their goal and the AEC desired no thermal pollution measures against any commercial nuclear reactors.[74] Due to many incidents that

[70] Duffy, *Nuclear Politics in America,* 2-3.
[71] Ibid., 29.
[72] Ibid., 11.
[73] Ibid., 55.
[74] Ibid.

resulted in killing fish across the country, the Department of the Interior's Fish and Wildlife Service (FWS), along with state and local governments began to take interest in thermal pollution.

Due to the energy crisis of the early 1970s, the Nixon administration decided to change their nuclear technology structure. In 1974, the AEC's subgovernment influence collapsed due to resistance to change and waning political influence, so subsequently, the U.S. Congress adopted the Energy Reorganization Act, effectively abolishing the AEC. Furthermore, the AEC's responsibilities were divided between two newly created independent agencies, Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA). The NRC regulated commercial power plants, nuclear materials, enforced licensing, inspection and enforcement of laws and policies. It also ensured safe usage of radioactive materials for civilian purposes while setting safety standards for people and the environment. In addition, the storage and disposal of nuclear waste and its transportation came under its domain. While the ERDA was given the responsibility of all major programs of research and development for all forms of energy that included nuclear reactors, uranium enrichment, nuclear weapons and research, national laboratories, and many other programs.

## Nuclear Waste Management Goals

By the 1940s it was a foregone conclusion that the nuclear energy was going to be a major part of American society, such as a destructive form or as a commercial energy source. Earlier, the hazards of RNW produced through the defense weapons program were the main concern of the waste management authorities, later, commercial nuclear energy became the dominant producer of the high-level radioactive waste. The radioactive waste storage and disposal goals from the nuclear energy production were divided up into three time periods:

1- The period of active use of nuclear energy, during which wastes are produced.
2- The period during which society takes an active role in managing the wastes, even if that role is merely surveillance. We assume that this period will be longer than the first, but it could be the same, or even shorter.
3- A period during which, because of social discontinuity or lack of concern, society ceases active management of wastes; during this period the system must continue to operate as designed, to isolate still-hazardous wastes from mankind.[75]

The waste management system comprises of various aspects of safety, environmental concerns, organizational and procedural mechanisms, institutionalized management, and implementation of established policies and procedures. Technological problems or concerns cannot be separated from societal conditions or economic factors. One of the most important aspects of the waste management program would be the involvement of

[75] William P. Bishop and D. H. Frazier, U.S. Nuclear Regulatory Commission, Proposed Goals For Radioactive Waste Management, Division of Fuel Cycle and Material Safety U.S. Nuclear Regulatory Commission Washington, D.C. 20555, Manuscript Completed: April 1977. Date Published: May 1978. pp 3.

interested groups, jurisdictional authorities, input by the citizens/residents of a given area in decision and planning processes. The jurisdiction authorities might include local, state, and regional governments, and their committees. Finally, all costs of a nuclear waste management system shall be identified, and financial resources provided by the concerned authorities.[76] It is understood that the waste management cost will be borne by those who benefit from the nuclear power/energy.

The responsibility of developing, regulating, implementing, operating, and managing the disposal of high-level radioactive waste falls on the U.S. government. Earlier, the AEC, and later, the Nuclear Regulatory Commission (NRC) regulated the high-level radioactive wastes in the following ways:

- Waste classification and high-level waste solids performance criteria: (1) what wastes must be placed into a HLW repository, (2) what form these wastes must be in Site suitability criteria, (3) what constitutes an acceptable site for a repository.
- Repository design criteria: what constraints must be placed on the development and operation of a repository.
- Isolating radioactive wastes from man and his environment for time periods sufficient to protect public health and safety and to preserve environmental values.
- Reducing to as low as reasonably achievable levels: the risk to public health and safety, and long-term social commitments such as land-use withdrawal, resource commitment, surveillance requirements, number of committed sites, etc.
- Repository Licensing specifications: what mechanisms will be used to review proposed facilities to determine if they will meet the above regulations and will be safe.[77]

One of the most contentious issues that the AEC faced was the selection of an underground geologic site as a permanent storage and disposal repository for the high-level RNW. The issue of repository site selection will be discussed in Chapter 3 in some detail, along with important political, economic, legal, and regional issues related to nuclear waste and the INL.

## The INL & Proximity to the Snake River Aquifer

By the late 1940s, the AEC approved the establishment of various nuclear reactor testing and weapons manufacturing facilities in numerous cities around the country. In 1949, the AEC established the INL, which is a complex of multi-faceted facilities spread-out across 890 square miles in eastern-Idaho desert, about forty miles west of City of Idaho Falls. Due to harsh winters and wind driven snow the desert landscape is desolate,

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[76] Ibid., 6-7.

[77] Workshop Material For State Review Of USNRC Site Suitability Criteria For High-Level Radioactive Waste Repositories, Manuscript Completed: August 1977, Date Published: September 1977, NUREG-0326, Waste Management Program-Division of Fuel Cycle and Material Safety-Office of Nuclear Material Safety and Safeguards-U.S. Nuclear Regulatory Commission-Washington, D. C. 20555, 13-15.

and in summer the sun and heat is relentless, while the shade is scarce as water.[78] Furthermore, due to volcanic activity, extreme pressure caused the desert floor to crack wide open and volcanoes pushed their way upward. There are at least three volcanoes that mark the desert floor and Big South Butte is the largest rising almost two thousand feet. By the 1880s, Mormon farmers started settling along the eastern and southern edge of the Snake River Plain. They could irrigate the crops of potatoes, sugar beets, seed peas, and wheat they grew in the region's light soil, which was enriched with volcanic ash and trace minerals. Other settlers were ranchers and sheepherders who claimed the mountainous valleys to the north, where the water flowed freely.[79] Inasmuch, the desert itself remained untouched due to its thorniness and desolation that provoked no enticement for the humans. The Snake River Aquifer is the most important water resource for Idaho farming and residential communities, and if it got contaminated by the nuclear waste, their crops, animals, fish, and drinking water would be irradiated to dangerous levels for a very long time. The Snake River Aquifer is the size of Lake Erie, which covers over 10,000 square miles. It starts near the Wyoming border, and along the way it is fed by various streams coming out of mountain ranges. The water and snowmelt seeps into the underground networks of cracks and fissures of mountain rocks and desert. The dangers to this vital freshwater resource through RNW contamination have been written and discussed in many circles inside the State of Idaho and outside. Kristin Iversen, a scholar/author, who also worked at the Rocky Flats Weapons facility near Boulder, CO opined regarding this issue that "This [INL] dump site is not safe. Sitting nearly six hundred feet above the Snake River Plain Aquifer, the site is in an earthquake zone and a flood plain. The aquifer below supplies water to Idaho farmers. The Idaho site currently holds 3.5 million cubic feet of plutonium waste that is not expected to stabilize for ten half-lives or 240,000 years."[80] The contamination of water in Snake River Aquifer by the RNW, (stored and disposed at the INL), would produce a fatal blow to the agricultural heritage of the Idaho farmers.

According to many scholars, activists, and politicians, deep underground storage is problematic at the INL at many levels. In this regard, Beatrice Brailsford, an activist with the Snake River Alliance, Idaho said in an interview with the author that the "US Geological Survey figures prove that Snake River Aquifer plain under the INL is only 550-600 feet deep, [which] is not deep enough for high-level radioactive waste storage or disposal."[81] To prove her point, Brailsford provided graph #1 that explains the location of the INL above the Snake River Aquifer, which is the main water source for many Idaho residents and farmers. Furthermore, she recalled that "in late 1970s heavy rains caused widespread flooding in eastern-Idaho, and the Pit#7 and Pit #9 lost most of their contents to the rushing waters."[82] All the water with the high level RNW swelled into the Snake River, killing thousands of fish and other wildlife due to extreme radioactivity in the

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[78] Willian McKeown, *Idaho Falls: The Untold Story of America's First Nuclear Accident* (Toronto, Canada: ECW Press, 2003), 26.
[79] McKeown, *Idaho Falls*, 26-27.
[80] Kristin Iversen, *Full Body Burden: Growing up in the Shadow of Rocky Flats* (New York: Crown Publishers, 2012), 195.
[81] Beatrice Brailsford. phone Interview conducted by the author. 16th February 2016.
[82] Brailsford, Interview, 2016.

water. The AEC has known that there is no dry, hydrologically, and geologically-sound deep underground space at the expansive INL complex, nevertheless, the U.S. government continues to use it as a temporary storage for RNW generated in Idaho and outside of the State.

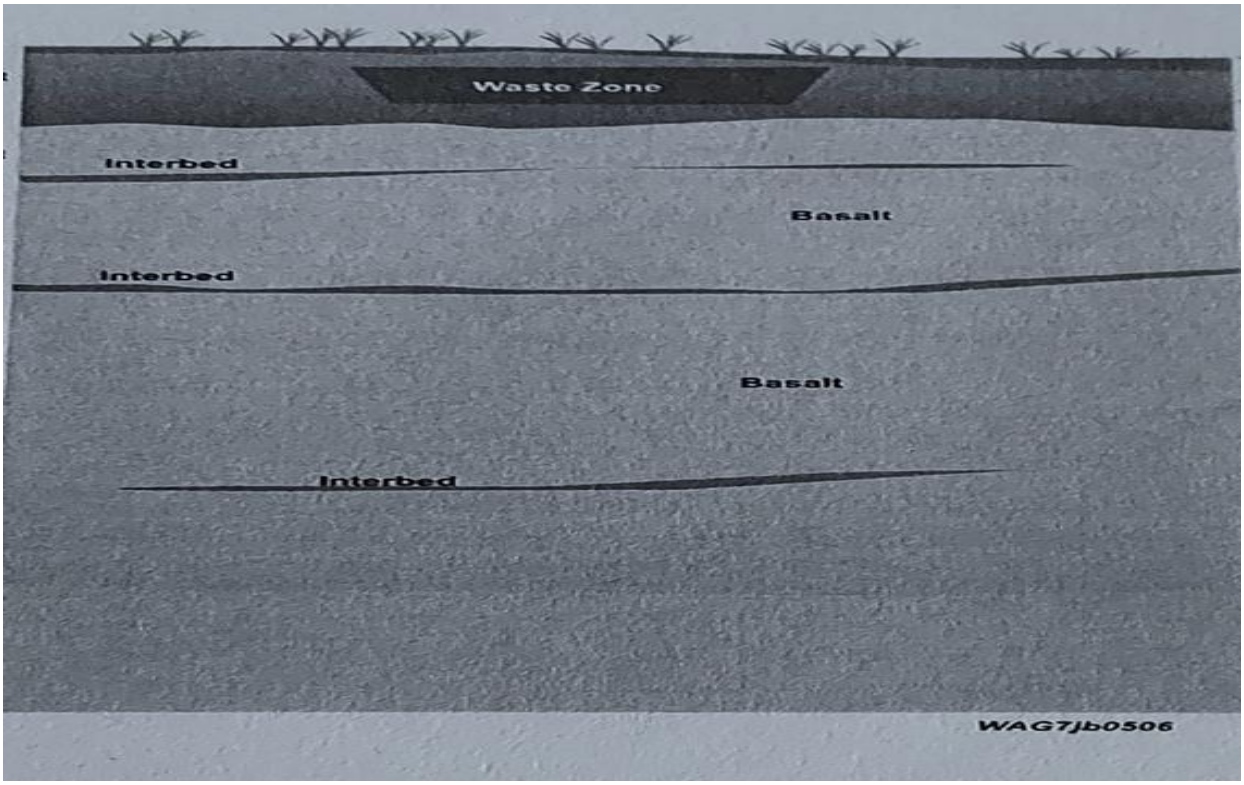


Figure 2.1 - The Snake River Aquifer Plain provided by Beatrice Brailsford with the Snake River Alliance on 16th February 2016.

It seems that the INL officials were not serious about the storage and disposal of the RNW, and their policies were not scientifically tested or practiced. More specifically, Bruce Schmalz, former head of the Waste Management at the INL stated, "It is easier to just throw them [RNW] away than to check for radioactivity and decontaminate them."[83] The AEC focused on the front-end production, and they didn't have collective mechanism, political understanding, and or regional cohesiveness to resolve the RNW storage and disposal issues. In this regard, Wilson notes that "No one spent much time then nor even later looking at the total system of the nuclear fuel cycle from fuel enrichment through the whole system of nuclear operation, reprocessing of spent fuel, and disposal of radioactive wastes."[84] Although, the AEC regulated and monitored the nuclear industry, they did not have a comprehensive RNW policy for permanent storage

[83] Rochester (NY), *Gannett News Service,* 16 November 1974.
[84] Carter, *Nuclear Imperatives,* 63.

and disposal at the INL, which could result in RNW contamination of Snake River Aquifer threatening agricultural heritage of the Idahoans.

The AEC established the INL in the eastern-Idaho desert, one of the thirteen Department of Energy (DOE) laboratories, which is considered the "Crown Jewel" of nuclear facilities due to its advanced nuclear and other fuel research programs and developmental capabilities. Earlier, the U.S. government was involved in performing national security operations and reactor testing at the INL. While commercial projects were put on hold, the atomic power programs were rapidly progressing. One analyst wrote in this regard that "The [INL] was originally planned to accommodate 10 reactors by 1964, but by 1963, 35 reactors had been brought into steady operation (control chain reaction) and four new reactor facilities were under construction."[85] Although all of these were experiment reactors were of different fuel categories, power-sources, and classifications, they were all producing nuclear waste that was stored, packaged, and disposed at the INL. The AEC and private sector concentrated on the front-end production, but not the storage and disposal of RNW, leaving these issues without any permanent solutions. Carroll L. Wilson, AEC's first general manager notes in this regard that, "During the formative years of waste management policymaking, 1945-1975, the issue was never given a very high priority by the AEC leadership. Waste was unglamorous; the management of it was not a pressing problem and could therefore be postponed."[86] Yet, the AEC officials are optimistic about the radioactive waste being isolated from the biosphere and humans for many more years than previously estimated through newer technological innovations which could enhance safety methods and procedures for storage and disposal of the RNW. More specifically, Stacy notes that in May 1952, for the first time, thirteen acres of land were dedicated at the INL for nuclear waste disposal. They dug six feet wide by nine hundred feet long trench. It was named the NRTS Burial Ground, and they were now providing waste disposal services amongst other services to the private contractors and researchers.[87] At the INL, this is the first in a series of allocating lands for RNW disposal, designing of the trench, and establishing a process for storage and disposal of RNW at their complex.

## The AEC & RNW storage/disposal policies

In the absence of solid knowledge or established safety standards for the storage and disposal of RNW, the nuclear industry started dumping, mishandling, and abandoning it across the country. According to some reports, in the 1940s a federal contractor was allowed to pour 37 million gallons of radioactive liquid waste into shallow wells at an energy plant in Tonawanda, New York. This practice continued for thirty-five years, until in 1980, the New York State Assembly Task Force for Substances uncovered documents describing the practice.[88] As a result of this negligent practice, the RNW had

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[85] "Many Great Milestones in Atomic Achievement Have been Reached in Idaho," April 1964, File 9, Box 167, Len Jordan Papers, Boise State University Archives (hereafter referred as BSUA).
[86] Office of Technology Assessment, *Defining Radioactive Waste,* 203.
[87] Stacy, *Proving the Principle*, 76-77.
[88] Donald L. Barlett and James B. Steele, *Forevermore: Nuclear Waste in America* (New York, W. W. Norton & Company, 1985), 64.

seeped from the wells at Tonawanda into the adjoining land parcels, properties, and streams. Today, Tonawanda energy plant is closed, and it is considered a super-fund site, which means that there are large quantities of unsecure, undisposed, and high-level RNW on premises, and the cleanup of these radioactive materials will continue for some time at the expense of the taxpayers.

The U.S. government has tried various methods over the years to stabilize or minimize, the RNW, and researchers at several AEC laboratories tested different methods of stabilizing the high-level RNW through calcination process, where liquids are heated to make dry, granular solids. At the National Reactor Testing Station [The INL] at Arco, Idaho, more than 500,000 gallons of liquid waste from fuel processing were converted into solid form between 1963 through October 1964. The solidification process reduced the volumes of liquid wastes by about 90 percent."[89] Later, these solid forms of RNW were stored in a stainless-steel bins that were cooled by air circulation. While scientists at the Brookhaven National Laboratory at Long Island, New York have been trying to develop a process to convert high-level RNW into solid form and place them in phosphate glass containers because they had proven to be long lasting.[90] Aforementioned measures of solidification of the RNW would have reduced the size of the volume and placed them in a stainless-steel canister or a phosphate glass containers but these processes are not reducing the radioactivity emitting from the nuclear elements and they are still hazardous to the environment, water, wild-life and human beings.

For the AEC, this was a time of transition and evaluation of new methods of storage and disposal of nuclear waste that are safe and economically feasible, resulting in a permanent solution to the ever-growing volumes of RNW. In 1959, Abel Wolman, a professor at John Hopkins University told a congressional committee, "In this context, There was a period, perhaps 10 years ago, when the problem of radioactive waste was considered to be nonexistent."[91] Although Wolman's claim was overstated, in essence it captured the overarching argument of finding safe storage and disposal method of RNW. Seaborg, chairman of AEC said in this context that "handling radioactive waste in a future large scale nuclear economy … was not a major problem."[92] Seaborg's statement was an attempt to oversimplify a very complex problem based simply on future growth of the nuclear industry, while there was no verified safe method of RNW storage and disposal at the moment. Although the RNW volumes increased exponentially, the dismissive attitude continued towards its storage and disposal by U.S. officials. In 1948, J. Robert Oppenheimer, American theoretical physicist dismissed the nuclear waste storage and disposal problem as "unimportant." However, later, Wolman told Oppenheimer in a meeting that "I have tremendous respect for your field of activity and your views," but added: "When you enter my field … your ideas as to how we shall manage this 'unimportant' problem are characterized almost completely by a total

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[89] J. Samuel Walker, *The Road to Yucca Mountain: The Development of Radioactive Waste Policy in The United States* (Berkeley: University of California Press, 2009), 27.
[90] Walker, *The Road to Yucca Mountain*, 27.
[91] Ibid., 1
[92] Ibid., 1.

ignorance of the nature of disposal."[93] Although Wolman couldn't get Oppenheimer to agree with his assessment of the RNW storage and disposal problem, he highlighted the current storage and disposal situation and practices in the country. The RNW was generally thought to be less complex, basically a technical problem that could be solved very easily. The AEC officials assumed that it was simply a matter of learning how to isolate the RNW from the biosphere while the best design/technology for a repository was not available. However, once all elements were practically available, the AEC could also look into the safety and protection of environment, water, and human beings.[94] The Cold War focus on front-end production of the atomic weapons and nuclear energy continued into early 1970s.

By the 1960s, there were various countries who had established peaceful and non-peaceful nuclear programs. In 1968, the Nuclear Nonproliferation Treaty (NPT), a global nuclear non-proliferation system was introduced that required the federal government's permission to export plutonium to a foreign country. In 1993, the Clinton administration announced a major change in line with the policy of nonproliferation and the use of plutonium that stated "the United States does not encourage the civil use of plutonium and, accordingly, does not itself engage in plutonium reprocessing for either nuclear power or nuclear explosive purposes. The United States, however, will maintain its existing commitments regarding the use of plutonium in civil nuclear programs in Western Europe and Japan."[95] This change in U. S. nuclear energy policy had several dimensions to it that were criticized by friends and foes alike. However, the NPT treaty aimed to reduce nuclear weapon stockpiles, to cutoff the production of fission materials, and to delegitimize the use of nuclear weapons. This was the start of voluntary reduction of the U.S. nuclear energy projects and weapons, which resulted in more high-level RNW at the INL.

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[93] Ibid., 12.
[94] Duffy, *Nuclear Politics in America,* 184.
[95] Committee on Separations Technology and Transmutation Systems - Board on Radioactive Waste Management - Commission on Geosciences, Environment, and Resources – *National Resource Council. Nuclear Wastes: Technologies for Separations and Transmutation* (Washington, D.C.: National Academy Press, 1995), 367-368.

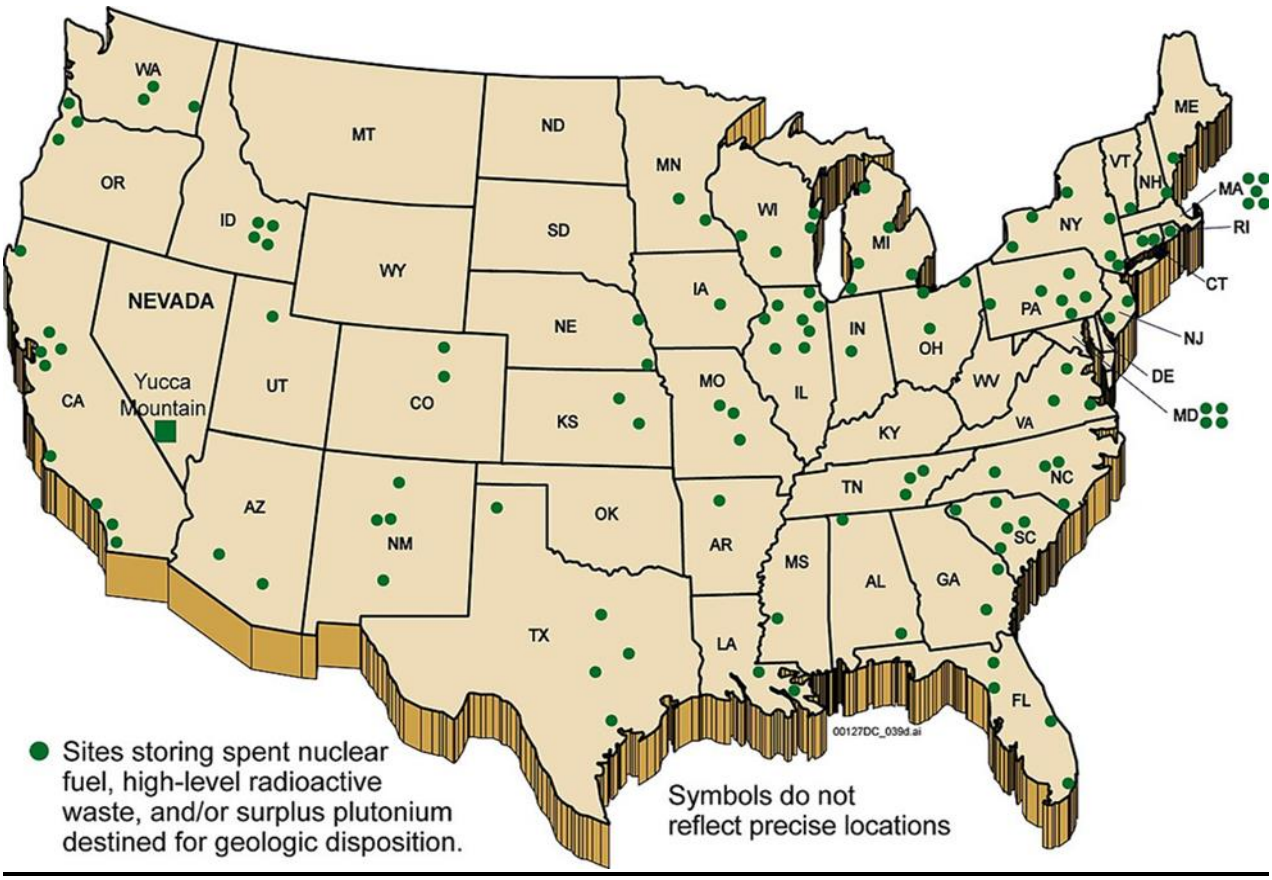


Figure 2.2 - Courtesy of U.S. Department of Energy, Nuclear Waste Locations at USA.jpg

## The Manhattan Project & RNW Sites

After WWI ended, it was not a revelation to people that terror of technologically advanced weapons would bring about a new age of peace and calm amongst nations in the near future. In 1921, a journalist wrote that "When we have discovered the secret of the atom, it is likely that all nations will be ready and willing to lay down their arms and abolish their armies and navies."[96] His prediction came true, at least for a while; U.S. government through "The Manhattan Project" built world's first nuclear weapons, and in August 1945, American bombers dropped two nuclear bombs over two Japanese cities to put pressure on the Imperial Japan for an unconditional surrender during the tail end of the WWII. The world polity was stunned by the ferocious power of the new weapon, and this unassailable advantage made the United States a military super-power in the world. After the WWII, the U.S. government was eager to develop their atomic technology that could be used for both constructive and destructive purposes. After realizing the enormous potential of nuclear technology, many nations started planning for it, however, early on there was no debate about permanent solution of the nuclear waste generated by

[96] Spencer R. Weart, *The Rise Of Nuclear Fear* (London: Harvard University Press, 2012), 13-14.

the nuclear technology. “The Manhattan Project” produced the first atomic bombs, and also the high-level radioactive waste that are being stored temporarily in 169 underground steel tanks, each with a capacity of 500,000 to 1 million gallons at: the Hanford Reservation in Washington, (in more than 100,000 fifty-five-gallon barrels stacked in long rows, one atop another); at the Idaho National Engineering Laboratory [INL] in Idaho Falls, Idaho; and in fifty underground steel tanks, each with a capacity of from 750,000 to 1.3 million gallons at the Savannah River plant near Aiken, South Carolina.[97] The earliest generated volumes of high-level RNW are still waiting for the Department of Energy (DOE) to permanently store, package, and dispose them.

Another site where the AEC dumped much of the uranium ore from the Manhattan Project is the Niagara County dynamite plant in Tonawanda, New York; the same town that was turned into a radioactive dump in 1944 to store uranium waste and other nuclear garbage. Furthermore, the uranium refining secretly under way produced radioactive sludge that started arriving at the ordnance works site in 1944, after part of the former dynamite reservation became a chemical warfare depot. Radioactive waste was trucked in from other states and plutonium-related University of Rochester animal experiments. According to reports, 55 million gallons of uranium waste was injected into wells there during the 1940s. So far, $215 million has been spent for the cleanup of the Tonawanda facility, however, it requires tens of millions of dollars to finish the cleanup project. So far, 201 cases have been filed by former workers, and none has been paid.[98] The high-level RNW storage and disposal at Tonawanda has been problematic for government officials, industry experts, and citizens from the day one due to their strong radioactivity emitting nature for hundreds, maybe thousands of years.

Due to multi-layered ad-hoc nuclear waste policies practiced by the AEC, at the present moment there are over one hundred sites across the country where nuclear waste materials are stored, packaged, or disposed of. One of them is the Mallinckrodt Chemical Works in St. Louis, MO that has been part of the Manhattan Project since the World War II-era program that refined weapons grade uranium, while [9,000 tons] of nuclear waste was illegally dumped at the landfill in Bridgeton in 1973.[99] Mallinckrodt Chemical facility was enriching uranium in downtown St. Louis, and since they ran out of room to store and dispose nuclear waste materials, the U.S. government secured about 20 acres near Lambert St. Louis Airport. Furthermore, Missouri State Senator Maria Chapelle-Nadal states how the nuclear waste was illegally dumped: “In the 1950’s there was a St. Louis County, but it was mostly farmland, and the haulers were paid by the loads that they were able to get rid of. So the more radioactive waste they were able to get rid of, they got paid, not knowing there’s an impact,” furthermore “And Mallinckrodt said we

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[97] Barlett, *Forevermore*, 63.

[98] Andrew Z. Galarneau, Atomic Fallout, 60 years later Manhattan Project’s legacy of radioactive waste, concerns over ex-workers’ health remain issues in WNY, The Buffalo News, August 5th, 2005. Accessed on 07/15/2022. www.buffalonews.com/news/atomic-fallout-60-years-later-manhattan-projects-legacy-of-radioactive-waste-concerns-over-ex-workers/article.

[99] Associated Press, Cleanup at West Lake Landfill slowed after more nuclear waste found, spectrum news, St. Louis, Published March 18, 2022, Accessed 08/10/2022. www.spectrumlocalnews.com/mo/st-louis/news/2022/03/18/cleanup-at-west-lake-landfill-slowed-after-more-nuclear-waste-found.

don't want to have any of the liability and the U.S. Government said you won't - but we will own all of this uranium."[100] But St. Louis residents did not understand the full impact of nuclear radiation, however, with time they began to realize their perils through higher number of cancers and other diseases in the North County near the Coldwater Creek area. Undoubtedly, the Mallinckrodt Chemical plant and neighboring properties were contaminated with high-level RNW, as a result, a superfund allocation by the federal government authorized a contamination cleanup, which has been going on since early 1990's and it will continue into the foreseeable future.

Another location near the St. Louis Airport is the City of Hazelwood which has about five acres lot used for process drying facility for ore residues and uranium and radium-bearing wastes that were processed during the period 1942 through the late 1950s. In 1977, the Health and Safety Research Division of the Oak Ridge National Laboratory found out that the soil there had measure amount of contamination. Originally, this site was not intended to be a radioactive waste disposal facility. This facility is located on Latty Avenue which was owned by the Continental Mining And Milling Company of Chicago from 1966 – 1974 who used it as a process drying facility for ore residues and uranium and radium-bearing processed wastes previously generated at a different location.[101] The federal government claims that the ore residues have been removed from the site and transferred to other storage areas but in 1976 it was discovered that the radiation on the site exceeded the criteria established by the NRC for release of the site for unrestricted use.[102] This site is longer being used for processing radioactive materials, and there is an advisory against the use of well water, caution about groundwater migration and atmospheric releases. More specifically, there are nuclear wastes storage and disposal problems with this site, and it is not safe to conduct any business on it or near it.

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[100] Nick Thompson, Manhattan Project Part 1: Waste From WWII Era Atomic Bombs Left Behind in St. Louis, OzarkFirst.com, Posted: February 9, 2016, Accessed on 08/10/2022. www.ozarkfirst.com/local-news/manhattan-project -part-1-waste-from-wwii-era-atomic-bombs-left-behind-in-st-louis/

[101] J.A. Adam and V.L. Rogers, *A Classification System for Radioactive Waste Disposal – What Waste Goes Where?* June 1978, Manuscript Completed: June 1978, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, U.S. NRC, Washington, D.C. 20555, NUREG-0456, FBDU-224-10. 181-182.

[102] J.A. Adam, *A Classification System for Radiation Waste Disposal*, 183.


Figure 2.3 - Image courtesy of Tom Borgman with the *St. Louis Post-Dispatch* in 1989.

The West Valley nuclear fuel reprocessing plant near the Allegany County border operated between 1966 – 1972 recovering uranium and plutonium from spent fuel for reuse in nuclear power plants. The plant was owned by New York State but operated by a private company, and the operation of the plant faced severe economic and ecological issues because they couldn't get the waste solidified or encased with the available technology, while the most challenging issue was the handling of the aging 500,000-gallon tanks of the commercial nuclear waste.[103] It was discovered that nuclear materials had leaked and migrated from at least one of the clay-capped disposal trenches. In 1975, a trench had filled with water, and it had overflowed, either due to a faulty clay cap, spring water, or both. An even more serious possibility existed that part of the burial grounds might wash into a series of creeks that eventually flow into Lake Erie. Earlier, the New York State and nuclear authorities had made false promises to the residents of the town of West Valley to gain their cooperation. Carol Mongerson with the West Valley Coalition states in this regard that, "They promised us 'It won't leak' and, 'It will make you rich.' Well, we're not rich and it did leak; there's plutonium in a dam three miles away."[104] The only option available to the local residents is to wait and watch. Later, the West Valley plant was declared a superfund site for cleanup of the RNW on site, and it has been going on for over a decade. According to U.S. Environmental Protection Agency

[103] Statement by Frank P. Baranowski, Director Division of Nuclear Fuel Cycle and Production, U.S. Energy Research and Development Administration, Joint Committee on Atomic Energy, Congress of the United States, November 19, 1975, Waste Inventory, 4. Accessed 05/20/2022.
[104] Thomas V. Peterson, *Linked Arms: A Rural Community Resists Nuclear Waste* (Albany: State University of New York Press, 1990), 25-26.

(EPA) that a number of investigations and remedial activities have taken place since 1975 to mitigate releases from various trenches on site.[105] The INL's site has many similarities with the West Valley Reprocessing Plant, such as its capacity to accumulate RNW and store them on site.

The INL sits on top of the Snake River aquifer, and the ever-growing volume of radioactive nuclear waste their caused great concern amongst the local residents about their safe storage and disposal policies/practices, while there are reports revealing negligence and inattention in that regard. Larry J. Mann, a U.S. Geological Surveyor and author, reported: "From 1952 to 1988, approximately 30,900 curies of tritium were contained in wastewater generated by the ICCP (Idaho Chemical Processing Plant) and the TRA (Test Reactor Area) at the [INL]. The wastewater at the ICCP was discharged directly to the Snake River Plain Aquifer."[106] Specifically, the contamination of the water sources was a major source of concern for the residents of Idaho, who have been mostly associated with agriculture and related fields. Furthermore, unlined percolation ponds were then used at the INL until fuel reprocessing operations ceased. Leakage from the Idaho Nuclear Technology and Engineering Center (INTEC) high level waste storage tank farm in 1972 contaminated soil and the aquifer including thousands of curies of strontium-90 and cesium-137 and other radionuclides. Chloride, fluoride, nitrate, sodium, and sulfate, which are all toxic and hazardous elements, were discharged in wastewater and the contaminants from INTEC extend far south of it.[107] According to U.S. government, buried waste: past, present and future: radioactive waste is basically plowed under at many sites at the INL, such as ATRC past percolation ponds and the burial site for the SL-1 reactor accident.[108] But most wastes were buried in unlined soil pits and trenches at INL's Radioactive Waste Management Complex (RWMC). Radioactive wastes from the INL complex, various DOE facilities and U.S. entities were dumped at RWMC since 1952, based on the assumption that the contaminants would take thousands of years to migrate. The chemical and radioactive waste from DOE's Rocky Flats weapons plant has been given the most focused attention by the State of Idaho where

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[105] Hazardous Waste Cleanup: Western New York Nuclear Service Center in West Valley, New York, United States Environmental Protection Agency, Accessed 07/20/2022, EPA.gov https://www.epa.gov/hwcorrectiveactioncleanups/hazardous-waste-cleanup-western-new-york-nuclear-service-center-west.

[106] Larry J. Mann, Tritium in Ground Water at the Idaho National Engineering Laboratory, U.S. Geological Survey,
Updated June 1990 accessed 03 April 2019, Idaho Falls, Idaho,
http;//pubs.usgs.gov/wri/1990/4090/report.pdf.

[107] US Geological Survey, An Update of Hydrologic Conditions and Distribution of Selected Constituents in Water,
Snake River Plant Aquifer and Perched Groundwater Zones, Idaho National Laboratory, Idaho, Emphasis 2006-
08, DOE/ID-22212, Report 2010-5197, 2010. Accessed 07/21/2022.

[108] US EPA, EPA Superfund Record of Decision: Idaho National Engineering Laboratory (USDOE) 12/01/1995,
EPA/ROD/R10-96/147, 1996. http://www.epa.gov/superfund/sites/rods/fulltext/r1096147.pdf. Accessed 07/21/2022.

chemical wastes continue to exceed maximum contaminate levels.[109] For example, Transuranic waste 7 from the Rocky Flats Plant included extensive amounts of chemical solvents that were buried at RWMC until 1970.[110] An estimated 88,400 gallons of organic waste included 24,400 gallons of carbon tetrachloride: 39,000 gallons of lubricating oil; and about 25,000 gallons of other organic compounds, including trichloroethane, trichloroethylene, perchloroethylene, toluene, and benzene. About 17,100 Ci of plutonium238, 64,900 Ci of plutonium-239, 17,100 Ci of plutonium-240, and 183,000 Ci of americium-241 were buried during 1952 to 1999.[111] It is clear from the aforementioned information that high-level RNW was generated at the INL, buried, and disposed in various parts of the complex, and more high-level RNW was brought in from facilities from outside of Idaho.

Later, in December 1979, the *Idaho Statesman* reported that Lee Stokes, head of Idaho's Environmental Office reported that 5.4 million pounds of chemicals were dumped into the Snake River Aquifer last year by the Idaho National Engineering Laboratory (the INL). The Idaho Governor called for an end to injections of chemicals into the Aquifer and into the shallow wells. In the same report Jack Dalton, chairman of the Boise State University chemistry department said that the discharges contain "fairly high levels" of chemicals. Furthermore, Stokes said that the INEL [INL] could halt both radioactive and chemical discharges "almost immediately" and could dump wastes into temporary holding ponds. Additionally, there's "no reason" that the discharges should continue. He pointed out towards an important issue that "Talking about whether chemicals are violating regulations is a waste of time, when we really need to be talking about how to get them out of there."[112] However, the INL administration responded to the query of the State of Idaho that the amount of chemicals discharged into the Snake River Aquifer were within the AEC standards and it is lawful.

In 1952, the AEC built the Rocky Flats Fuel Fabricating Facility near Golden, CO on a four-square mile parcel that manufactured hollow plutonium spheres that served as trigger devices for nuclear weapons. Since the water table was high in the area, the high-level RNW were stored above ground as the burial of the RNW was not an option. In

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[109] See more about Idaho's Settlement Agreement at https://www.deq.idaho.gov/inl-oversight/oversightagreements/1995-settlement-agreement.aspx. Accessed 07/21/2022.

[110] Transuranic waste (TRU) contains isotopes above uranium in the periodic table of chemical elements. They are long-lived by-products of weapons fabrication, fuel assembly and reprocessing. Unfortunately, uranium was not included in the definition, although it is also a long-lived contaminant and poses a threat to the environment and human health when in concentrated leachable forms. Accessed 07/21/2022.

[111] Idaho Cleanup Project for the for DOE-NE Idaho Operations Office, "Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory," DOE/NE-ID-11201, Revision 3, February 2007. Accessed on 07/21/2022. https://ar.inl.gov/images/pdf/200702/2007022600146TUA.pdf

[112] Lonnie Rosenwald and Rod Gramer, INEL chemical waste – legal, but 'unacceptable', *The Idaho Statesman*, Published December 15, 1979 – page 18.

April 1954, Rocky Flats shipped several drums of low-level plutonium waste to the NRTS [INL]. For decades, after that initial shipment from the Rocky Flats, a steady stream of waste found its way to the INL's Burial Ground.[113] Later, the INL started receiving transuranic waste from the Rocky Flats which has alpha plutonium elements that emit higher degree of radioactivity for a longer duration. In 1957, there was a big fire in the glovebox at the Rocky Flats plutonium manufacturing facility that caused most of the main plant to burn down. All of the bulky clean-up debris was shipped in thousands of barrels to the INL's 'Burial Ground,' by then, first thirteen acres at the INL, including ten trenches had been filled up.[114] The fire resulted in spreading radioactive and toxic contaminants all the way to the Denver metropolitan area, however, the residents were not told about the fire until 1970. The AEC due to strikes and labor shortages changed their burial practices to rolling the drums from the Rocky Flats directly laid from the backs of trucks and let them lay in the pits where they landed. Additionally, Stacy notes that the [INL] Burial Ground was designated for solids only, but a few sealed containers of liquid apparently found their way into the first trench.[115] In other words, the Rocky Flats fuel facility had been sending high-level liquid RNW along with the solid RNW to the INL, which made accountability, manageability, and later, retrievability a quite more difficult.

In addition, between 1960-1963 the AEC designated the INL as a commercial dump, a disposal area for commercial radioactive wastes from such places as hospitals and universities, previously the wastes from hospitals and universities were being dumped in the oceans. At the Rocky Flats facility radioactive and toxic waste have been dealt with from the beginning, the effluence is run through a regular sewage disposal plant and empties into nearby Woman Creek. While solid and liquid waste is packaged into fifty-five-gallon drums, and much of what remains is incinerated.[116] There are thousands of fifty-five-gallon drums stored above ground at the Rocky Flats, while some are buried, and plutonium laced waste is in danger of leaking. Again, in 1969, there was a major fire at the Rocky Flats plutonium processing buildings 776 and 777, which destroyed one plutonium conveyor line, two tons of the plexiglass windows on the glove-box lines, and tons of plastic walls, and the damages exceeded $70 million. The cleanup took two years to complete, and over time Rocky Flats removed most of the waste barrels and covered a portion of the area with asphalt. Then, some of the barrels were sent to a waste site [The INL] in Idaho and some were buried on-site (eventually contributing to groundwater contamination).[117] The AEC tried to minimize the damage at Rocky Flats by stating that there was no immediate danger to humans or wildlife, while admitting that plutonium had migrated off-site.

More specifically, the AEC knew that the INL sat on top of the Snake River Aquifer and the danger of RNW leaking into it was real, but there were no other commercial landfill sites for high-level RNW available in the country besides Oak Ridge,

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[113] Stacy, *Proving the Principle,* 78-79
[114] Ibid., 80.
[115] Ibid., 78.
[116] Kristin Iversen, *Full Body Burden: Growing Up in the Nuclear Shadow of Rocky Flats* (New York: Random House, Inc. 2013), 8.
[117] Ibid., 42-43-77.

Tennessee, which was too far and economically not feasible. Although the INL complex has its own environmental and geological issues, the AEC chose to ignore them. In February 1962, nearly two inches rain fell on snow that caused localized flooding, opening up two trenches and one pit; waste was dumped beyond the excavated area.[118] In addition, the AEC did not have accurate records of what type of RNW was being stored in the trenches at the INL because the shipments from the Rocky Flats did not have all items clearly marked. Some drums were already leaking contents, others had liquid RNW which was not authorized, and others had wrong items packaged in them. Stacy notes that decades later, analysts studying the waste regretted that standardization had not arrived earlier; they could have used better information about early waste types and their specific locations. Early records of what went into the trenches are not complete.[119] By the early 1970s, the INL managers were suggesting to the AEC to look for a permanent waste disposal site elsewhere because this one sat on top of the Snake River Aquifer, and it could not become a permanent commercial dump.

By the late 1970s there was a strong push back by the government officials citing budget constraints and appropriation limitations regarding the funding requests for various proposed projects by the AEC. In January 1980, it was reported by the *Idaho Statesman* that the Carter Administration was unwilling to provide $500 million for a slagging pyrolysis incinerator, a giant furnace that would prepare the INEL (INL) waste for shipment out of the state. Funds to develop a permanent storage site for wastes from the INEL (INL) and other federal sites were also dropped. Although every day, more and more RNW piled up in temporary and unacceptable locations in the country. The INEL (INL) is such a location, some 90,000 cubic feet of nuclear waste is dumped there each month. And since the government cannot find a site for permanent storage, they are planning to keep the waste in Idaho for a long time.[120] In retrospect, it is clear that over the years many U.S. administrations have made mistakes, neglected, or kicked the can down the road in terms of implementing permanent long-term RNW storage, packaging, and disposal policies.

The RNW situation at the INL is described succinctly by an INL worker that disposed of their radioactive waste by digging a trench with heavy equipment. They put the smaller decommissioned particles in a pasteboard box and the larger debris was dumped directly into the ground. This includes the material from the Colorado atomic plant. As you know, the Idaho Falls [INL] disposal burial ground is right over the nation's largest underground water supply, which handles water for the vast Northwest. We know that we have tanks of radioactive material, a liquid, that is leaking into the ground. Furthermore, newspaper reports and magazine articles began calling attention to the fact that the AEC's waste-disposal practices are indeed sloppy. Solid wastes are buried in shallow trenches in Idaho [The INL] along with exposed liquid wastes as well.[121] Furthermore, National Academy of Sciences (NAS) had reviewed AEC radioactive-

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[118] Ibid., 81.
[119] Ibid., 81.
[120] *The Idaho Statesman,* 'Temporary' storage, January 14, 1980.
[121] Metzger, *The Atomic Establishment,* 154-155.

waste-disposal practices for years and the NAS roundly condemned not only the Idaho operation, but AEC atom dumps everywhere they existed.[122]

In March 1979, the first commercial nuclear reactor meltdown happened at the Three Mile Island Nuclear Power Plant, Unit 2 near the town of Middleton, Pennsylvania. The Unit Two generator had a partial meltdown due to a valve malfunction. As a result, radiation escaped the plant's thick walls.[123] Although there were no deaths, the radiation escaped about three miles from the facility. This accident caused irreparable damage to the reputation of the commercial nuclear industry, and it took six years for examining, cleaning, and sanitizing process to decommission the plant. In 1986, the radioactive debris from the crippled reactor was loaded up in steel and lead casks and shipped by rail to the INL for research and storage pending disposal.[124] In reality, the INL facility had become the first-choice nuclear waste disposal destination for most domestic and international facilities, however, government officials insisted that it never was intended to be permanent.

## Sea dumping of the RNW

The first disposal method chosen by the AEC was the sea dumping of the low-level RNW due to the expansive nature of the ocean, which started in the State of California from 1946 – 1960s, and later, in 1947, off the New Jersey coast and Massachusetts Bay. In 1970, the Environmental Protection Agency (EPA) study disclosed that 47,500 barrels jettisoned in the Pacific Ocean near the Farallon Islands [CA] had ruptured…The EPA reported to the International Atomic Energy Agency that it was clearly evident that plutonium had been "released from the radioactive waste containers," and the radioactivity levels were elevated in the seabed and marine life.[125] The news of ruptured RNW drums on the ocean floor near the Farallon Islands caused many researchers to wonder if the fish caught in the ocean was safe enough to be consumed by the human beings. In addition, objections from the State of Texas and numerous County officials grew louder against dumping of RNW in the Gulf of Mexico, as they were afraid of negative effects on the marine life. Furthermore, they were concerned about the drums rupturing due to water pressure, endangering food supplies and recreation operations.[126] Later, by 1970, sea dumping of RNW by the AEC ended due to economic and convenience reasons, rather than the health or environmental consequences. In 1970, the Louisiana State legislature adopted a resolution opposing disposal of radioactive wastes in the Gulf of Mexico as it is "completely untenable" and a source of "great alarm." The idea of sea dumping of the RNW by the U.S. government into the Gulf of Mexico caught the attention of Government of Mexico, and in 1969, they filed a complaint with the State

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[122] Ibid., 151.
[123]New York (*NY) New York Daily News,* 29 March 1979.
[124] New York, *New York Times,* 2 July 1986.
[125] Barlett, *Forevermore,* 196.
[126] George T. Mazuzan and J. Samuel Walker, *Controlling the Atom: The Beginnings of Nuclear Regulations, 1946-1962* (U.S. Regulatory Commission: Washington, D.C. 2010), 369.

Department citing deep concerns over the plans of AEC dump site in the waters of the Gulf of Mexico.

The West Valley nuclear fuel reprocessing facility, which operated from 1957 – 1983, had frequent fires, radiation releases, and other mishaps. Studies indicate that leukemia, a form of cancer related to radiation exposure, was detected in higher numbers around nuclear reactors and waste management facilities, while thyroid cancers were already occurring in such places at an

alarming rate. In 1983, due to an operator mistake, high-level waste was released into the ocean. Although the government said there was no cause for concern, they recommended that people should avoid the contaminated stretch of beach; marine animals and plant life had been affected. Levels of radioactivity in marine life ran several hundred times above average.[127] This is not an isolated incident of deliberate dumping of RNW in the ocean by the U.S. government. In this regard, Patrick E. Tyler, *New York Times* reporter wrote that the U.S. nuclear submarine captains would dump their radioactive coolant waters from their reactor plants directly into the ocean, however, this practice was discontinued in the early 1960's, according to a submarine commander. Furthermore, sometimes when U.S. Navy tried to dispose the drums containing radioactive nuclear materials would not sink, naval aircraft had to be summoned to strafe them with machine-gun fire until they sank. In 1950'some radioactive drums/containers were dumped

Figure 2.4 - A soldier rolls a 55-gallon drum toward the edge of the USS Calhoun County. Image by Times Staff Writer at the Tampa Bay Times on Dec. 23, 2013

[127] Barlett, *Forevermore,* 113-114.

in 300 feet of water 12 miles from Boston Harbor, and other containers were dumped around the Farallon Islands off San Francisco coast.

A report by Daniel P. Finn from the AEC to the Senate Intelligence Committee stated that between 1946 – 1970, the AEC supervised the disposal of about 107,000 drums of low-level radioactive wastes at sites off the Atlantic and Pacific coasts. The U.S. government ended ocean dumping of low-level RNW about 1970 after the passage of the Marine Protection, Research and Sanctuaries Act which was referred to as the ocean dumping act.[128] Today, U.S. Navy operates about 125 nuclear-powered submarines and 15 nuclear-powered surface ships. The highly radioactive fuel in their reactor cores requires occasional replacement, and the spent fuel is shipped to the INL for reprocessing, which yields new fuel and high-level radioactive wastes, that are shipped to storage sites at Hanford, WA and the Savannah River Plant near Aiken, S.C.[129] After ending the sea dumping of RNW, the AEC started allowing the burial of the commercial waste on land at Oak Ridge facility and the INL, just as it did with the defense RNW, and this was another shift in their storage and disposal policies.

## Shallow Grave Burial

After ending sea-dumping of the low-level RNW, U.S. government started burying commercial waste with defense refuse at Oak Ridge, Tennessee, and National Reactor Testing Station [The INL] in Idaho Falls, Idaho. In addition, commercial nuclear power expanded exponentially between 1966 and 1968. Public utilities committed to purchasing sixty-eight nuclear units, compared to the twenty-two nuclear units they had ordered between 1955 and 1965.[130] This boom in nuclear power energy in America created large volumes of high-level RNW that required permanent storage, packaging and disposal facilities that were in different phases of planning and formation. However, U.S. nuclear industry insiders assumed that it was safe for solidified wastes from reprocessing to be buried in shallow graves. But Raymond Castaing, a member of the French Academy of Sciences, argued against the burial in a report that "The group feels that, at all events, it is not possible for the time being to proceed with the definitive burial of wastes that can be classed as alpha wastes [a category including reprocessed solids] ….The group feels that any decision of principle calling ultimately for such irreversible burial would be premature in the current state of our knowledge."[131] The conclusion that can be ascertained from the aforementioned statement is that the knowledge and technology about the shallow burial of RNW was not complete and it should be further looked into before making it a nuclear industry practice in all regions.

By the early 1967, the AEC started allowing shallow land burial of low-level RNW, however, they did not pay attention to geological hazards or precipitation levels in

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[128] Patrick E. Tyler, "The U.S., Too, Has Dumped Waste at Sea," *New York Times,* Published: May 4, 1993. Accessed 08/07/2022.
[129] Ibid.
[130] J. Samuel Walker, *The Road to Yucca Mountain,* 42-43.
[131] Barlett, *Forevermore,* 40.

their chosen areas. For example, a twenty-acre nuclear waste graveyard (NWG) near Sheffield, Illinois holds 3.1 million cubic feet of waste in trenches that have been collapsing. This NWG was closed in 1978, after radioactive tritium showed up in nearby test wells. Furthermore, in one trench some fifteen depressions and holes have occurred, some ten feet deep. By early 1982, tritium, a radioactive isotope had flowed off the property and contaminated adjacent land parcel. Besides low-level RNW buried at Sheffield, there is thirty-four pounds of plutonium and seventy pounds of enriched uranium, both of which are high-level RNW.[132] According to the industry experts this perilous environmental condition at Sheffield is not an isolated case, it is created by government's ill-prepared RNW policies and deficient monitoring regiment. In other words, U.S. government lacked comprehensive policies, guidelines, and a monitoring system regarding the storage and disposal of RNW. Robert Hershey, a *New York Times* reporter notes that "until the mid-1970s, the Government and the [nuclear] industry concentrated on building new reactors, assuming that waste would be taken care of," additionally, "there is still some controversy as to whether the scientific means exist to dispose safely of highly radioactive waste that can remain dangerous for hundreds, perhaps thousands, of years."[133] Hershey's article exposed the AEC's lack of policy for the permanent storage and disposal of RNW, which was not restricted to one project or a region, but it was a national issue that needed to be discussed and debated at a national forum to reach a final decision.

By the end of 1970, the AEC announced a strategy for disposal of nuclear waste to minimize environmental contamination:

> High-level waste storage at reprocessing plants should be converted to an AEC-approved solid form within five years of the time of generation; second, that the solidified waste would be delivered to a federal repository not later than ten years after the reprocessing of the irradiated fuel, with reprocessors paying a one-time fee in return for the government's assuming full responsibility for ultimate disposal.[134]

However, various government agencies resisted this policy due to perceived flaws, particularly regarding the storage of plutonium. Due to its potential for weaponization, the Departments of Energy (DOE) and Navy (DON) expressed security and legal concerns regarding the AEC's new strategy and sought exemptions from it. The DOE and DON accounted for the vast majority of nuclear waste stored at the INL, undermining the effectiveness of the policy in the event of such exemptions.

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[132] Ibid., 40-41
[133] *New York Times,* 25 January 1981.
[134] Carter, *Nuclear Imperatives and Public Trust,* 61.

Figure 2.5 - Aerial view of the Radioactive Waste Management Complex [The INL]
The yellow area shows the location of Pit 9. Image from Vadose Zone Journal.

## Compaction of the RNW

The AEC wanted to find processes or methods to better handle the radioactive solid waste because the elements of plutonium and transuranium nuclide need to be stored separately, and they also must be retrieval for a relocation or repackaging at a later date. This concept in mind, in 1969, the AEC asked the General Managers Task Force on the AEC Operational Radioactive Waste Management to study the process of compaction that would reduce the waste volume for storage and would be easily retrievable. The Committee looked at three elements in the radioactive solid waste process, sorting, incineration, and compaction. They recommended that one-half or more of the radioactive solid waste currently generated at AEC sites are compactable and can be reduced in volume by factors ranging from 2 to 10. They made a thorough cost analysis of all radioactive solid waste management operations and established radioactive waste storage container criteria for various storage conditions, such as life, size, shape, weight, and cost. Furthermore, in 1970, the Committee recommended that as storage costs increase recovery becomes more attractive and the amount of waste to be compacted and stored is reduced.[135] These recommendations would be applied through land burials of all radioactive solid waste compactions on temporary basis. However, the retrievability of the compacted radioactive solid waste would be feasible if there was a geological

[135] Compaction of Radioactive Solid Waste, A Report to the General Manager's Task Force on AEC Radioactive Waste Management, Prepared by AEC Working Group on Compaction, U.S. Atomic Energy Commission, WASH 1167, June 1970. 1-2.

repository available for permanent storage and disposal. In this regard, Hugh Johnstone, an American writer states that "High-level waste is the most difficult to deal with since it is very radioactive and will remain so for hundreds of years. A possible long-term solution is to convert it to glass blocks which can be buried deep underground."[136] But the problem is not the conversion of RNW into a glass form, it is finding an underground site that is dry, hydrologically, and geologically sound which could be trusted for many centuries without any major accident, earthquake, flood, and that it is relatively low maintenance.

Another proposed process of disposal of nuclear production plant wastes was simulation and injection of the waste into the sedimentary rocks obtained from outcrops, quarries, and deep wells. Injectivity can be maintained over a longer period of monitoring the ionic balance and particle-size distribution of waste stream.[137] At the INL, waste operations have their own problems and perils. The storage containers/drums contain internal obstructions, such as the first batch was built without openings for the calcined material's eventual removal for permanent disposal. Plus, at the INL the soil and groundwater have been contaminated in various areas. Before 1984, treated wastes from reprocessing spent fuel were discharged directly into the Snake River Aquifer below.[138] The AEC did not introduce a comprehensive RNW storage and disposal plan that resulted in safe disposal of wastes into the Aquifer. By 1991, the Cold War came to an end, the U.S. and Russian governments respectively began to dismantle thousands of nuclear warheads that produced stockpiles of plutonium pits. In 1996, Energy Secretary Hazel R. O'Leary noted that "The arms race is over," and furthermore, "Our struggle now is to get rid of this sea of plutonium."[139] Later, the U.S. and Russia decided to dispose of 34 metric tons of surplus weapons-grade plutonium. The INL received most of the high-level RNW from the disarmament projects.

## Salt Mine permanent RNW storage & disposal

The AEC had been investigating permanent disposal of high-level RNW in a deep geologic repository since the 1950s. In 1957, the National Academy of Sciences' Committee on Waste Disposal, which had been established at the request of the AEC, published a report which concluded that salt formations offered the most promising geological setting for high-level liquid radioactive waste.[140] This information in hand, the Carey mines in Lyons, Kansas became the focus of their search as it had bedded salt geologic formations that had been there for over 200 million years, and they were dry and resistant to water infiltration, which made them best suited site for the permanent burial of high-level RNW. In 1965, a small number of metal canisters containing used fuel from

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[136] Hugh Johnstone, *Nuclear Waste and Radioactivity* (New York: Franklin Watts, 1990), 20.
[137] J. B. F. Champlin, Laboratory Testing and Evaluation of Porous Permeable Rock For Nuclear Waste Disposal, Abstract, United States Department of The Interior, U.S. Bureau of Mines 1967. Report of Investigations 6926, TN23.U7-no. 6926-622.06173, U.S. Dept. of the Int. Library. Accessed 07/28/2022.
[138] Alley, *Too Hot to Touch*, 73-74.
[139] Ibid., 76-82.
[140] J. Samuel Walker, An "Atomic Garbage Dump" for Kansas: The Controversy over The Lyons Radioactive Waste Repository, 1970-1972." Kansas History: A Journal of the Central Plains 27 (Winter 2006-2007): 266-285.

an AEC test reactor in Idaho [the INL] and other electrically heated cannisters were placed in twelve-foot-deep holes drilled into the floor of the Carey mines. Furthermore, it was understood that "At the end of the two-year program, sufficient data should be available on which to base a determination of the feasibility of using underground salt mines for the full-scale disposal of high-level radioactive waste."[141] The U.S. Congress allocated $3.5 million to buy the Carey mines land, to acquire an additional 800 acres around it, and to prepare a conceptual design of the repository.[142] The AEC decided to perform salt mine tests for a few years before a final decision was taken to approve a permanent high-level RNW repository. However, the AEC failed to understand the sentiments of the people and politicians of Kansas against the proposed high-level RNW geologic repository. This friction was captured by the editorial page of *Great Bend Daily Tribune* titled 'Underground Dump' that the "Atomic Energy Commissioners' remarks about storing waste materials in salt caverns located 1,000 feet below Lyons, have caused murmurs of discontent. People are just plain scared of anything that has to do with nuclear fission. It won't do AEC much good to try and salve Rice Countians' feelings with comments about how utterly safe the stuff is, because even the federal government is taking a nary a chance of having its workers glowing in the dark like watch dials."[143] Despite having several questions posed by the media and residents about the safety of the mines, the AEC assumed they had satisfied Kansas State government's requirements with pertinent underground environmental, heat, and radiation reports, thus, there would be no opposition to their project.

In 1970, after receiving supportive test results, the AEC designated the Carey mines as the tentative site for high-level RNW repository. This was good news for Idaho Senator Frank F. Church, who had been encouraging the AEC for many years to transfer the RNW from the INL to a permanent repository outside of Idaho. In March 1970, the AEC Chairman Glen T. Seaborg noted in his diary that the results of the Lyons tests were "very encouraging."[144] Despite assurances by the AEC, many Kansas residents believed that there were important questions that U.S. government needed to answer before starting the project. The *State Journal's* page of opinion posed a few items for the AEC to ponder, such as "A salt mine is recommended as the most satisfactory underground storage chest for the waste materials. Such formations are deep and dry, with resealing properties in case of earth fractures," furthermore "One factor to consider is the remote possibility of accident in shipment to the burial site, although the AEC has many years' experience in handling such transportation. Atomic wastes now interred in four other locations over the country would be moved to the new salt-mine depository."[145] Instead of answering the proposed questions, in order to gain public support, the AEC dangled significant economic benefits; 200 jobs connected with the Project Salt Vault. Furthermore, they mentioned that "It is possible that the presence of the repository may attract other commercial or nuclear related activities to this area."[146] The residents of

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[141] Barlett, *Forevermore,* 282-283.
[142] Barlett, *Forevermore,* 285.
[143] *Great Bend Daily Tribune,* Underground Dump, November 18, 1963.
[144] J. Samuel Walker, An "Atomic Garbage Dump" for Kansas, 271.
[145] Ibid., 273.
[146] Barlett, *Forevermore*, 285-286.

Lyons had been involved in agricultural activities for generations, and it is not a surprise that they were interested in gaining economic and technological benefits from Project Salt Vault, however, they wanted to get all pertinent information about the efficacy and safety of the project from the AEC before they could make a firm commitment.

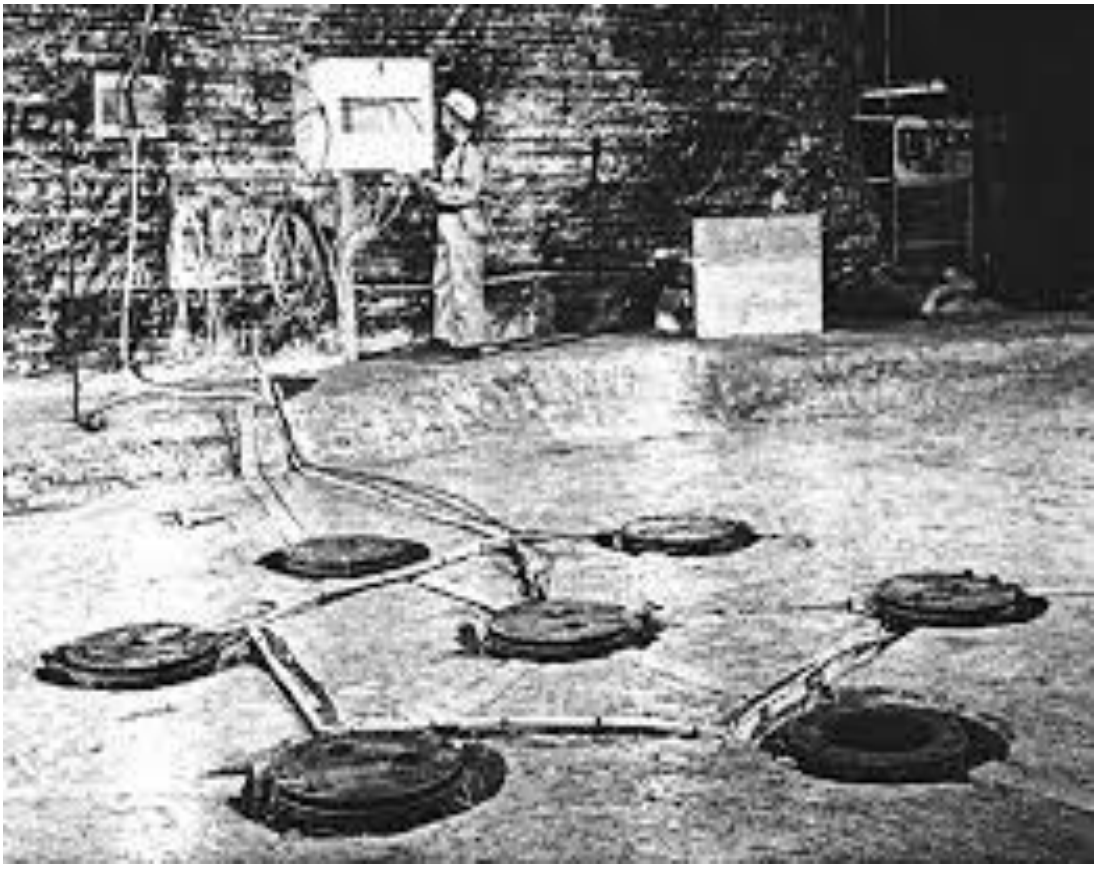

Figure 2.6- Image of Carey salt mine, Lyons, Kansas - Courtesy of U.S. Department of Energy

In order to show their neutrality, the AEC hired the Kansas Geological Survey to provide their assessment of the Carey mine site. In his report, Dr. William Hambleton described the earth above the salt mine "a bit like a piece of Swiss cheese" and if the water penetrated through one of the boreholes and seep into the salt mine containing RNW, the radioactive brine could flow out of the repository into the nearby groundwater resources. It was estimated 175,000 gallons of water that had been injected into a mine in the area to dissolve salt for a new cavern, and water had never flowed back to the earth's surface.[147] After receiving adverse information from Kansas Geological Survey, Governor Robert B. Docking in December 1970 stated that "It has seemed to us at times that the AEC has been more interested in convincing the public of the safety of the Lyons site rather than using these funds needed to carry studies to a conclusion."[148] After reviewing this information, Kansas residents and politicians became adamant not to allow the RNW storage and disposal project to go forward. In February 1971, the AEC came

[147] Ibid., 286.
[148] Ibid., 287.

under severe criticism from the Department of the Interior. Hollis M. Dole, an assistant secretary of the interior noted that "Such a permanent commitment of the wastes requires a very strong and scientifically convincing demonstration that the wastes will remain in a geologically relatively undisturbed and hydrologically isolated position for the several thousand years required for the decay of high level [waste]."[149] These revelations forced the AEC to abandon the Carey mines project in late 1971, and as a result, already interred radioactive reactor fuel canisters were retrieved and shipped back to the INL. This was a major policy failure for the AEC to establish their first high-level RNW repository at Lyons because they had overlooked the geological settings of the Carey mines before announcing it, and they had also underestimated public sentiments against the project. Still, the AEC had no prospects for a high-level RNW permanent repository in the country because no state was willing to establish one in their territory.

## The INL Waste Policies & Practices

At the moment, the U.S. government's plan regarding the RNW is to store and "decay cool" the spent fuel at the original nuclear reactor sites in the storage ponds for a decade or more. After that the RNW will be shipped to a monitored retrievable storage (MRS) facility, where the wastes would be stored temporarily, and later, they would be encapsulated and shipped to a deep geological repository. This is called the "once through" cycle because the spent fuel is not reprocessed and so it is not recycled.[150] The AEC announced on numerous occasions that the high-level and Transuranic RNW stored and disposed at the INL are for temporary purposes, and they will be moved outside of Idaho as soon as there is a permanent geologic repository available. However, for the meanwhile, the INL administration is responsible for the safety, efficacy, and manageability of the RNW. According to a report titled 'Review of Vitro Study of ICCP Type Wastes' about the methods for concentrating reactor wastes for storage, "The general principle in the disposal of radioactive waste is to reduce the liquid waste streams to a minimum volume (preferably to the solid state) and to store the final residue so as to preclude migration of the radioactive material to nature; all operations should be carried out at a minimum cost."[151] The ICCP stands for Idaho Chemical Processing Plant at the INL that recovers usable uranium from spent reactor fuel. Fuels clad in aluminum, zirconium, stainless steel, and graphite are processed; waste minimization of RNW is achieved, while also managing waste in compliance with all applicable laws & regulations.

The INL uses several different methods of waste treatment and disposal:

1- Modification of Large Storage Tank Method: achieved by storing waste in a mild-steel tanks installed in an open pit. A simple wall or shadow shield is

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[149] Ibid.

[150] National Research Council, *Nuclear Wastes: Technologies for Separations and Transmutation* (National Academy Press: Washington, D.C. 1996), 1.

[151] E. D. Arnold, Compilation and Analysis of Waste Disposal Information, United States Atomic Energy Commission: Oak Ridge National Laboratory, Oak Ridge, Tennessee. March 12, 1957. CF-57-2-20(Del.), 180.

used for protection against radiation. However, it must be mentioned that this method simply buys some time, it is a temporary solution as far as the final disposal is concerned to the overall waste storage problem.

2- Crystallization of Aluminum Nitrate: the corrosive waste is removed first, and the waste needs to age to reduce its activity, then reduction in waste volume is achieved through crystallization that helps in recovery of various elements. Although the reduced residues from this process would tentatively be confined to storage tanks, further research would be required to determine other means for permanent disposal.[152]

As discussed earlier, the AEC from its inception has been focused on front-end production of nuclear weapons, while there is no comprehensive RNW program in place. The RNW at defense sites is shrouded in secrecy, they managed/processed RNW into concentrated form or put in underground tanks, in order to dilute the RNW over time and later, it could be dispersed in the air, soil, and underground water. The cost of the waste management was kept under a tight budget by the AEC, which resulted in a massive amount of contamination through radionuclides, toxic metals and other chemicals during the operations, production, and or cleaning of the reactors. Another issue was the relaxed regiment of record keeping of the waste and quite often various spent fuels, chemicals, and solvents were mixed together as a brew for storage and disposal purposes.[153] Many concerns about the cleanup problems as a result of contamination of soil, water, and environment were discussed as early as 1948. The Williams Commission identified serious concerns about waste management policies at the nuclear weapons sites. Furthermore, it was reported that waste disposal practices had "not been developed with full consideration of the hazards involved," and that "the degree of risk justified in wartime is no longer appropriate."[154] The Williams Commission report was ignored by the U.S. government and RNW storage and disposal policies continued without any changes. However, in 1980s, the Cold War came to an end as the Soviet Union broke apart, and along with it the large-scale production of nuclear weapons in the United States came to an end. Later, a clear picture started to appear regarding the RNW across the nation's nuclear reactors, atomic weapons plants, and waste facilities.

At the INL, some of the liquid wastes were converted into dry granules, while some liquid waste was kept in containers. In 2006, the radioactivity of the reprocessing wastes at the INL was estimated to be about 41 million curies. Furthermore, spent fuel returned from university, government, and foreign research reactors are stored at the INL, and also the spent fuel from nuclear submarines, aircraft carriers, and training reactors belonging to the US Navy.[155] The researchers at the INL started work on converting liquid high-level RNW into a solidified form that would improve its storage and disposal practices. By 1963, the calcination process was discovered, where water is removed from the liquid high-level RNW, reduced to a solid form, and the *fluidized bed* process is

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[152] E. D. Arnold, Compilation and Analysis, 180-182.
[153] William M. Alley, *Too Hot to Touch: The Problem of High-Level Nuclear Waste* (Cambridge University Press: New York, 2013), 62.
[154] Alley, *Too Hot to Touch*, 62-63.
[155] Ibid., 64.

carried out in furnaces or kilns. The hot "fluidized" grains are sprayed with liquid high-level waste; hence, the heat vaporizes the water, the remaining part of the waste adhered to the solids. Within a year, half a million gallons of liquid high-level RNW had been transformed into 7,500 cubic feet of solid volume, which is better than 9 to 1 reduction in form.[156] Although the volume of liquid RNW has been reduced at the INL through the calcination process, the intense radioactivity emitting nature of plutonium in the spent fuel has not changed nor its risks to the environment, soil, water, or humans.

In December 1979, *The Idaho Statesman* reporters Rod Gramer and Lonnie Rosenwald stated that the INL had discharged billions of gallons of radioactive liquid waste into the aquifer below, from a plant which reprocesses spent fuel. After learning about this dumping of RNW into the Snake River Aquifer, Governor John Evans formed a Nuclear Waste Task Force (NWTF) to find out if there are any safer methods available to dispose of liquid waste, which could be utilized at the INL. The NWTF came back with four recommendations:

- Evaporation by placing the waste in a lined pond.
- Steam evaporation.
- Injection below the aquifer.
- Use of a closed or recycling system.

In response to the NWTF's recommendations, Richard Blackledge, a spokesperson for the Department of Energy (DOE) in Idaho Falls, said the INEL [INL] personnel and others have suggested that DOE "should look at different ways" to dispose of the radioactive waste, while "We consider the system we have now as safe."[157] The government considered placing the waste in an unlined seepage pond. But the seepage ponds had similar disadvantages as the shallow wells. An AEC official questioned the economic feasibility and land utilization in this case by stating that "There would be additional adverse impact of permanently committing six to ten acres of land area for an unlined pond, at a cost of about $500,000."[158] Furthermore, it was said that the use of a seepage pond was not in the line with current ERDA policies and guidelines. However, a seepage pond was already being used at the INL. In the defense of the government's position, Blackledge said it would be difficult for DOE to get congressional funding for the new recycling system because of its cost.[159] It is easy to ascertain from the aforementioned information that the AEC officials were not interested in hearing criticism from the public sources about their waste policies and practices in place, even if they were considered hazardous or detrimental to the public safety.

In conclusion, the U.S. government desired to increase their nuclear technological advantage after the Second World War and to provide a nuclear umbrella for their Western Allies against the Soviet hegemonic threat. The Cold War and the detonation of a

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[156] Ibid., 72-73
[157] Rod Gramer and Lonnie Rosenwald, "INEL Studied Waste-Dump Options: Aquifer Disposal Termed Best Method," The Idaho Statesman, printed December 15, 1979. Accessed August 22, 2022. Boise State University Archives (hereafter referred as BSUA).
[158] Ibid.
[159] Ibid.

nuclear weapon by the Soviet Union created an urgency in minds of the U.S. government officials to increase the production of the nuclear weapons. The AEC, the General Advisory Committee, the JCAE, and the nuclear power industry insiders exercised a complete monopoly over nuclear policies and programs for the first two decades. The aforementioned setup in American political and administrative system is considered a subgovernment model of policymaking. The subgovernment consists of midlevel executive agency bureaucrats, congressional committees or subcommittees, and the elite group interested in particular policy formulation and its implementation. The AEC's main goal was the development, production, and control of nuclear technology/energy for defensive and civilian applications, while creating safety and procedural standards for RNW. However, the AEC did not pay precise attention to solving the back-end problems of permanent storage and disposal of the RNW. The proximity of the INL and its ever-growing volumes of RNW to the Snake River Aquifer caused many Idaho residents and politicians to raise their voices against their state becoming a nuclear dump and the RNW should be removed and transferred to a permanent repository outside of Idaho. Furthermore, the AEC was having problems getting any state to volunteer for an RNW site within their territories. The AEC implemented temporary measures/policies for storage and disposal of RNW, such as sea dumping of nuclear waste. The sea dumping of RNW killed many fish and other marine life and the environment was adversely affected in the Farallon Islands, CA. The West Valley facility, Hanford Reservation, St. Louis, the INL, and many other nuclear waste facilities were leaking wastes into the environment, water, and adjacent properties. Shallow graves were used as a measure to solve RNW storage and disposal problem, and many locations found out the RNW, including plutonium had migrated to adjoining properties and water resources. The INL engineers came up with compaction of RNW as a way to reduce the liquid volumes of RNW into a solidified form, which is better for storage space and transportation process. The nuclear industry experts were convinced that the Salt Mine were the best option for a permanent geologic repository for the high-level RNW. The AEC tried to establish a geologic repository at the Carey mine in Lyons, Kansas, but it failed because the Kansas Geologic Survey report cited a large volume of water disappeared in the mine that was being used to clean mine sediments. Most of the Kansas politicians and residents became anxious about a change in the classification of the RNW that was being proposed for storage and disposal at Carey mine. The Carey mine project was cancelled by the U.S. government after severe pressure from Kansas politicians and residents for non-disclosure of dangers and hazards of high-level RNW. All the high-level RNW canisters were brought in from the INL to Kansas was returned back after the abandonment of the Carey mine project. The INL used various methods and innovative processes to store and dispose of the RNW. However, there were severe disagreements about their policy of disposal of nuclear wastes directly into the Snake River Aquifer due to the danger of contaminating it with the nuclear waste.

## Key points:

. U.S. government wanted to increase their nuclear capabilities and maintain a military edge.
. The AEC from its inception is responsible for production and safety of nuclear technology.
. A subgovernment model of policymaking was implemented without any public participation.
. The Civil Rights Movement and the Oil embargo brought a major energy policy shift.
. In 1974, the AEC is abolished and replaced by ERDA and NRC through the ERA.
. Nuclear waste management goals: production, management, and isolation from mankind.
. The Snake River Aquifer is a vital source of fresh water for Idaho residents/businesses.
. The INL sits on top of the Snake River Aquifer, and RNW contamination is a constant fear.
. The INL administration threw away RNW without taking any protective measures.
. In 1952, thirteen acres of land was used for nuclear waste disposal for private contractors.
. At the INL various methods to stabilize or minimize the RNW have been used and invented.
. The NPT aimed to reduce nuclear weapons stockpiles, materials, and delegitimized weapons.
. The Manhattan Project related many sites have high-grade RNW contamination problems.
. The INL's ICCP has discharged large volumes of RNW and chemicals in Snake River Aquifer.
. In 1954, Rocky Flats, CO started sending their low-level plutonium waste to the INL.
. The AEC designated the INL a commercial dump from 1960-1963 for commercial contractors.
. The INL RNW pits and trenches got flooded in 1962 due to excessive rains and snow.
. The RNW shipments from Rocky Flats did not have clear markings or designated waste.
. U.S. gov't cut funds to the INL for the incinerator that would help prepare waste for shipment.
. The NAS reviewed the INL waste storage and disposal policies and condemned their policies.
. Three Mile Island nuclear reactor meltdown debris brought to the INL for research and storage.
. The AEC chose sea dumping of the low-level RNW due to the expansive nature of the ocean.
. Shallow grave burial was adopted as a safe RNW disposal method, which proved to be wrong.

. The INL has large volumes of low-level and transuranic, and high-grade RNW in solid, liquid, and gaseous forms, all of which pose a unique set of storage and disposal problems.

. U.S. gov't picked Carey mines, Kansas as a permanent repository but the plan failed after the Kansas Geological Survey reported the disappearance of large volume of water in the mine.

. The INL utilized various forms of waste treatment and compaction procedures and methods.

. The Cold War ended with the collapse of the Soviet Union; it brought more high-level RNW to the INL due to mutual deweaponization of the nuclear arsenal.

. The NWTF provided safer methods of storage and disposal to the INL, but they were denied.

. The public input regarding the deficiencies of RNW program was not welcomed by the U. S. government, citing economic factors and land utilization as their excuse.

# Chapter 3

## The AEC: Politics of the Nuclear Waste

The U.S. government demonstrated the destructive power of atom in 1945 by dropping two atomic bombs on Japanese cities of Hiroshima and Nagasaki during the Second World War. Later, in 1950s, the AEC presented commercial nuclear energy as the cheapest and most abundant source of energy that would raise the standard of living around the world. In order to highlight this point, the Pittsburgh utility offered nuclear energy as a source of pollution control because local residents were against a coal-fired power plant. More specifically, Lewis L. Strauss, the AEC Chairman opined about the value of the nuclear energy by stating that "Our children will enjoy in their homes electrical energy too cheap to meter."[160] Although the AEC officials gladly presented the benefits of the nuclear energy to their fellow Americans and friends abroad, however, the question of what to do with the nuclear waste from the nuclear weapons program and the commercial nuclear power plants was rarely discussed or answered. By the late 1960s, there were over 129 sites in 39 states where high-level radioactive waste from the nuclear energy power plants and weapons production facilities were stored and disposed of. Additionally, there were over 70,000 tons of spent fuel from nuclear reactors, while another 20,000 large canisters of defense related RNW that were waiting for permanent disposal/repository.[161] The RNW storage and disposal problems needed a comprehensive government policy that was economically feasible, physically manageable, and protected the soil, water, marine life, and human beings. In this regard, in 1949, the AEC Chairman David Lilienthal acknowledged that radioactive wastes could become "a subject of emotion and hysteria and fear …[but] we do not believe those fears are justified provided technology applies itself to eliminating the troubles."[162] However, Robert Oppenheimer, Chairman of the AEC's General Advisory Committee had earlier rejected the RNW problem as "unimportant." It is understood that there were differing knowledges and point-of-views within the AEC about the wastes problem, moreover, there were many political, legal, geological, and territorial issues that were hindering in finding a permanent solution to the RNW storage and disposal problems.

Earlier, the AEC officials were not bothered about the RNW storage and disposal issues, however, later, as many nuclear power plants became operational, they started generating large volumes of high-level radioactive wastes which became a major source of concern for them. Generally nuclear waste is recognized as low-level or high-level

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[160] Alley, *Too Hot to Touch*, xiii.
[161] Ibid., xiv.
[162] Ibid., 3.

radioactive waste. “Low-level” RNW includes materials that are highly radioactive parts of nuclear reactors, such as, cooling water pipes, and radiation suits and more, while waste from the medical institutions and research facilities include radioactive treatments, x-rays and they are easy to dispose of because the level of radioactivity is around ten through fifty years. On the other hand, “High-level” RNW consists of materials from the core of the nuclear reactors or the nuclear weapons, such as, uranium, plutonium, and other highly radioactive elements, comparatively very hazardous as they emit large amounts of intense radiation for a very long time. It also has but is not limited to chromium, toxic heavy metals, solvents, and lead. Furthermore, along with having intense radioactivity, some of the elements can be mobile in their environment and they can contaminate soil or groundwater if not contained in their storage or disposal areas.[163] In addition, the aging nuclear reactors need to be Decommissioned, which includes floors, concrete, walls, roof, machinery, and other heavy/large parts that are compressed for storage and disposal. Last but not least is the Transuranic waste which is contaminated with plutonium and other long-lived radioactive substances, but it does not emit immense radioactivity as the high-level RNW. However, it is lethal because a speck of plutonium will produce cancer or death if ingested and it will remain hazardous for tens of thousands of years.[164] Today, it is understood that all forms of RNW are hazardous and dangerous which require a comprehensive and verifiable storage, packaging, and disposal mechanism that is economically and administratively viable, and which is reliable for hundreds of years, preferably thousands of years.

Most of the RNW at the INL are either high-level or transuranic wastes which are found mostly in liquid form but there are also some wastes that are in solid or gaseous forms. The DOE has built 11 underground tanks for the storage of liquid radioactive waste in the Idaho Nuclear Technology and Engineering Center Tank Farm at the INL, where the spent fuel from the Naval Reactor program is stored in these tanks that are from highly enriched uranium fuel. These tanks at the INL are relatively newer than the ones at the Hanford Reservation or Savannah River Site. The purpose of this processing was not to recover plutonium for the weapons program, but to recover the residual highly enriched uranium.[165] The vast majority of the waste is in a liquid form, but a small number of insoluble solids can be found at the bottoms of the tanks. The classification of these waste has been in dispute for some time and is the subject of litigation. The State of Idaho considers this waste to be high-level waste, while DOE considers the waste to be mixed transuranic waste. Another major concern at the INL is transuranic waste that has been disposed of in near-surface pits and trenches prior to the practice of retrievable storage for disposal at a permanent federal facility, the WIPP.

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[163] Warren S. Melfort, *Nuclear Waste Disposal: Current Issues and Proposals* (New York: Nova Science Publishers, Inc. 2003), 91.
[164] Barlett, *Forevermore*, 148.
[165] National Research Council, *Risk and Decisions: About Disposition of Transuranic and High-Level Radioactive Waste* (The National Academies Press: Washington, D.C. 2005), 53-54.

Figure 3.1- The INL Image is courtesy of U.S. Department of Energy, Tank Description: Eleven larger and four smaller stainless-steel tanks at the INL, Waste Volume: each larger tank capacity of approximately 1.14 x 106 Litres (300,000 gallons), each smaller tank capacity of approximately 1.14 x 105 Litres (30,000 gallons), and total capacity of 15 tanks approximately 1.29 x 107 Litres (34,200,000 gallons).

As most of country's nuclear power plants exhausted their storage capacity, there were few options besides a permanent repository. By 1983, most of the nuclear power plant operators had installed redesigned holding racks for the spent fuel assemblies which is called "re-racking," however, that is still a temporary fix. Another quick fix was "Away from reactor" (AFR) pools which were comparatively cheaper to build, and they could safely store spent fuel for many more years. Despite AFRs positive feasibility there were many critics in various states. At least seven state legislators imposed various prohibitions on the construction or expansion of local nuclear storage facilities. More specifically, a California statute prohibited construction of nuclear power plants until the state "finds that there has been developed, and that the United States through its authorized agency has approved, and there exists a demonstrated technology or means for the disposal of high-level nuclear waste."[166] All States' in the Union have dealt with the nuclear waste issue differently because some generate large volumes of low-level RNW,

[166] Robert Stobaugh and Daniel Yergin, *Energy Future: Report of The Energy Project at The Harvard Business School* (New York: Vintage Books, 1983), 155-157.

so their wastes need more storage and disposal area, while other might produce high-grade RNW but the volume as not as high.

## Manipulation of Nuclear Waste Issue

The AEC failed in 1971 to establish a geological repository for high-level RNW at Lyons, Kansas. However, in 1978, Fred Beierle led Southwest Nuclear Company submitted an application for a low-level nuclear waste repository with the Rice County, Kansas. This was considered to be the revival of the Carey mine project with a low-level nuclear waste retrievable storage facility. Later, Southwest Nuclear Company was renamed as Rickano, which announced that "Radioactive waste materials will primarily come from hospitals, research institutions, nuclear power plants, naval shipyards, and others who offer services to the nuclear industry."[167] Furthermore, James L. Harvey, President of Rickano clarified the aforementioned statement by adding old lab coats, medicine bottles, hypodermic syringes, and other items to the list to be deposited. In 1980, Rickano bought the Carey mine for $350,000, and announced to have $1 million worth of repairs to the mine shaft and other areas of operation.[168] If Beierle succeeded in establishing a low-level nuclear waste repository at the Carey mine, it would have been the first repository to open since Barnwell in New York which was established in 1971. Later, in 1982, company changed its position by stating that "Rickano would bury all forms of low-level waste, including that from atomic power plants."[169] The Kansas residents became suspicious of Beierle's intentions, who was known as a 'super salesperson' in nuclear waste industry. Kansas residents believed that this was the federal government's way of getting their foot in the door, and later, they would change the mode/classification of waste. Beierle was merely a front man in the government's greater plan to establish a nuclear waste repository at the Carey mine.[170] The Rickano proposal is still waiting approval by the Kansas authorities, whom are part of Central Interstate Low-Level Radioactive Waste Compact that included eight other states, and the Low-Level Radioactive Waste Policy Act of 1980 made all states responsible for the wastes they generated and guided them to establish regional burial grounds with mutual consent. However, there were disagreements over monetary and logistical issues amongst the eight states over the Carey mine being the regional low-level nuclear waste burial center. Kansas officials confirmed that they could not act on Rickano's application until the Congress approves the Central Interstate Compact.[171] Finally, the aforementioned inaction over the Rickano application by the Kansas authorities put an end to the establishment of a private or federal nuclear waste repository at the Carey Salt mine, Lyons.

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[167] Barlett, *Forevermore*, 288-289.
[168] Ibid., 294.
[169] Ibid., 289.
[170] Ibid., 294.
[171] Ibid., 294-295.

There has been friction for some time between the federal and state governments over the RNW policies and practices. After receiving a *New York Times* clip in the mail from a customer in the east coast, Robert A. Erkins President of the Snake River Trout Company, the world's largest trout farm wrote a letter to Idaho Governor Don W. Samuelson stating that for "several months, hundreds of railroad cars will be carrying from Rocky Flats [weapons facility] to the Snake River plain of eastern Idaho an estimated 330,000 cubic feet of contaminated waste to be buried below ground by the Commission's National Reactor Test Station [INL]."[172] The east coast customer was concerned about trout in Idaho being contaminated with the large volumes of plutonium and other forms of RNW stored at the INL which sat 600 feet on top of the Snake River Aquifer. The customer's concern about the RNW proximity to the Snake River Aquifer was further explained by the chief of the Water Pollution Section of the Idaho State Health Department that it was "crevassed and fissured all the way down to the aquifer."[173] Furthermore, the Idaho residents were not only concerned about the INL being situated on top of the Snake River aquifer but also that the INL administration was using deep disposal wells to inject liquid radioactive wastes directly into the aquifer. In this regard, the INL officials offered various assurances to make their point about the safety of their waste disposal systems. William F. Ginkel, manager of the AEC's Idaho Operations office stated that "We have substantial technical expertise. There is no real or potential basis for alarm – ever," and his operation was "reviewed continually by the Department of Health, the AEC and people like the National Academy of Science [NAS]."[174] More specifically, Ginkel was implying that the NAS was satisfied with the RNW storage and disposal policies at the INL. However, Ginkel's declaration was not completely accurate because the NAS had reviewed AEC's radioactive-waste disposal practices for years and the NAS had roundly condemned not only the Idaho operation but the AEC nuclear dumps everywhere they existed.[175] Since the AEC knew that the NAS had issued an unfavorable report about their nuclear waste policies and practices, they were hesitant to further comment or discuss it.

Idaho Senator Frank Church wanted to review the "suppressed" NAS report, and he said that "I am increasingly troubled over the trend towards secrecy in our government. If security reasons are involved or the Commission does not feel the report is factual, it should say so. But to simply indicate that the Committee did more than the AEC felt it should and use that as a basis for not releasing the report is a dubious procedure."[176] The very next day after Senator Church's statement, the NAS report of 1966 was released by the AEC that confirmed the fears of the worried Idaho residents. The NAS report noted that the AEC's waste-disposal operations in Idaho "are conducted over one of the largest of the country's remaining reserves of pure fresh water," found cause for worry in 1965 "over the prevailing belief" that the basalt surface layers of only "several hundred feet provide a reservoir for safe storage of tremendous quantities of

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[172] H. Peter Metzger, *The Atomic Establishment* (New York: Simon and Schuster, 1972), 150.
[173] Metzger, *The Atomic Establishment,* 151.
[174] Ibid., 151.
[175] Ibid., 151.
[176] Ibid., 152.

wastes of all levels of radioactivity and that no hazardous amounts of radioactivity will percolate down to the water table."[177] It was estimated that seepage of RNW would take fifty to sixty years to reach the Snake River Aquifer, even at that rate, it was a worrisome scenario for the Idaho residents and trout farmers.

After the Commission's report was released, it became clear that Ginkel's assurances regarding the safety measures taken for the storage and disposal of RNW by the AEC were not precise. The NAS went further in their report and asserted that the AEC's Idaho disposal site in 1965 created major anxieties: 1) that *consideration of long-range safety are in some instances subordinated to regard for economy of operation*, and 2) that some disposal practices are conditioned on *over-confidence* in the capacity of the local environment to contain vast quantities of radionuclides for indefinite periods without danger to the biosphere."[178] The aforementioned reservations about the storage and disposal policies employed by the AEC at the INL were becoming common knowledge in Idaho and nationally. Earlier, in 1955, the Committee had concluded that "continuing disposal of low-level waste … above the water table, probably involves *unacceptable* long-term risks."[179] It seems that the AEC had ignored the findings by the NAS because as early as 1960 the NAS said that "*No existing AEC installation is in a geologically acceptable location for disposal of highly radioactive liquid waste* …" furthermore, in 1965, NAS said: "… *none of the major sites* at which radioactive wastes are being stored and disposed of is geologically suited for safe disposal *of any manner of radioactive wastes* other than very dilute, very low-level liquids."[180] In the 1960s most of the controversy over RNW disposal practices surrounded the lack of long-term policy at the AEC installations, later, which could have had serious consequences. In this regard, the AEC ignored or disregarded complaints from the NAS. Seaborg wrote in his memoirs that the agency "erred in dealing with nuclear waste [by leaving] behind a terrible legacy – the massive residue of contaminated wastes at Hanford and other nuclear materials production sites."[181] For all intent and purposes, Erkins had done his job by highlighting the AEC's unsafe RNW storage and disposal policies and practices at the INL. After the release of the NAS report, the AEC announced within a year that they would remove the buried wastes at the INL to a permanent repository outside of the state of Idaho. Most probably, this announcement by the AEC to remove the buried RNW at the INL would not have happened, if the dangers of RNW contamination of the Snake River had not been pointed out by the Idaho trout farmers.

The Idaho trout farmers were not the only ones to point out the hazards of nuclear waste and the lack of comprehensive storage and disposal mechanisms. In the 1950s and 1960s there were numerous articles and newspaper reports that pointed out the dangers RNW posed to the environment, water, marine life, and human beings. Walter Schneir, a journalist described the radioactive waste as clearly "the most hazardous and treacherous

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[177] Ibid., 152-153.
[178] Ibid., 153.
[179] Ibid., 153.
[180] Ibid., 153-154.
[181] Walker, *The Road to Yucca Mountain,* 49-50.

material man has ever tried to deal with."[182] After the Second World War, the newly created AEC performed dual roles as the regulator and production-in-charge of the atomic materials. Earlier nuclear waste was the by-product of the nuclear weapons programs, and later, after the invention of commercial nuclear energy in the 1950s most of the high-level nuclear waste was accumulated from that source. The AEC tried to overcome many complexities related to nuclear energy program; lack of political expediency, accountability before public officials, and the problem of the ever-growing volumes of RNW which had caused great concerns in many regions of the country. In December 1978, *Business Week* printed an article in opposition to nuclear power which reported that "the most politically sensitive of all nuclear energy's problems is waste disposal."[183] In this regard, the AEC was challenged from its inception to implement comprehensive storage and disposal wastes policies and practices due to the duality of their role, which caused many political, economic, judicial, and environmental problems. By the early 1970s a deep geologic repository for high-level wastes was still a theory and the federal government was looking for answers. In fact, the federal government had spent around $1.7 million on commercial waste management in 1972 and $317 million in 1982. Furthermore, the federal government invested approximately $270 million a year in commercial high-level waste management and the solution of repository issue.[184] The AEC and nuclear industry insiders agreed that more resources, technical expertise, and political will was required to finally establish a deep geologic repository.

In mid 1960s, an internal squabble between the AEC and the Congressional Joint Committee became known, which had lasted for ten years over the role of the federal government in developing advanced reactors and bringing them to the market.[185] These differences were bound to happen due to the AEC's role in the nuclear technology as the chief of the production of nuclear weapons program while also being the safety and standard bearer for the American society. Earlier, some optimistic voices were in favor of the AEC policies and practices regarding the storage and disposal of the RNW. In January 1948, Karl Z. Morgan, director of the health physics department at Clinton Laboratories in Oak Ridge, Tennessee gave a favorable assessment. Morgan said: "There is considerable evidence that as long as present standards are maintained," he wrote in the *Scientific American*, "the plutonium projects will remain among the safest industrial operations in the country."[186] The AEC followed two approaches towards the storage and disposal of RNW. First, the high-level wastes produced from the reprocessing of the reactor fuel was to concentrate them "in as small a volume … as possible" and store them "in a safe manner" to prevent the escape of radioactivity.[187] Second, the handling of the much larger volume of low-level wastes was to dilute their radioactivity to levels that posed "no danger to plants, animals, or humans."[188] However, the radioactive isotopes

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[182] Ibid., 2
[183] Ibid.
[184] Jacob, *Site Unseen*, 74.
[185] Robert Stobaugh and Daniel Yergin, *Energy Future: Report of The Energy Project*, 143.
[186] Jacob, *Site Unseen*, 6.
[187] Ibid.
[188] Ibid.

created through the nuclear fission emitted varying measures of radioactivity, intensity of radiation, and duration. Earlier, the AEC had overlooked the concerns about the contamination of water, soil, environment, and safety of humans in favor of the national security plans and demands of the front-end-production. Later, the AEC encouraged the expansion and progress of commercial nuclear energy projects, while the waste programs did not receive a comprehensive makeover.

## Nuclear Spent Fuel, Wastes, and Proliferation

The INL became a hub of technological prowess and innovation, more specifically, research on multiple energy projects and other defense related programs. The spent nuclear fuel was reprocessed there between 1953 through 1992 to recover the fissile isotope uranium-235. During the reprocessing operations the nuclear fuel and related materials are dissolved in highly acidic solutions, such as nitric acid, hydrofluoric acid, and sulfuric acid, which are used while the granite is burned. The spent fuel waste at the INL contains uranic and transuranic isotopes spawned through the reprocessing of spent fuel which is unique because it is stored while it is still in highly acidic form.[189] But the commercial reprocessing of nuclear spent fuels or wastes were banned by President Jimmy Carter in 1978 due to fears of proliferation of nuclear waste. According to reports, in the mid-1960s, nearly 400 pounds of enriched uranium vanished from the Nuclear Material & Equipment Corporation, near the town of Apollo, Pennsylvania. CIA analysts publicly speculated years later that the uranium had been smuggled to Israel, where it was used to make that country's first nuclear weapons.[190] Certainly, the most controversial incident of reprocessing of nuclear reactor fuels occurred in May 1974, when India detonated its first atomic weapon in the Thar Desert, near the Pakistani border. It was built with a reactor, fuel, and technology supplied by Canada and the United States to help India generate much needed cheap electricity. The Indian Atomic Energy Commission had obtained the plutonium for the nuclear bomb by reprocessing fuel rods. Michael W. Sharp, Canada's external affairs minister said: "All of this assistance was intended to help India in meeting the critical energy needs of the Indian people and was provided to, and accepted by, India on the basis that it would be used for peaceful purposes only."[191] By mid-1980s many countries had acquired nuclear energy knowledge and technology, and the race to acquire nuclear weapons at any cost was underway.

In 1981, President Ronald Reagan lifted the ban on the commercial reprocessing. Later, in 1996, during the Clinton administration, the National Academy of Sciences declared commercial reprocessing of the spent fuels to be impractical and too costly. While in 2001, President George W. Bush ordered to develop reprocessing technologies. Later, in 2006, President Bush announced an ambitious new initiative The Global Nuclear

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[189] National Research Council of The National Academies, *Research Needs for High-Level Waste: Stored in Tanks and Bins at U.S. Department of Energy Sites* (National Academy Press: Washington, D.C. 2001), 22.
[190] William McKeown, *Idaho Falls: The Untold Story of America's First Nuclear Accident* (Toronto: ECW Press, 2003), 194.
[191] McKeown, *Idaho Falls*, 90-94.

Energy Partnership (GNEP). Theoretically, the GNEP initiative would have paired one of the new reprocessing methods that did not create separated plutonium (UREX+ or pyrochemical reprocessing) with fast reactors to burn the fuel from the reprocessing plant.[192] However, the controversial part of the initiative was the creation of new technologies for reprocessing and fast reactors would be setup in the United States and a few other nations. These selected nations would provide the aspiring nuclear nations with conventional reactors and nuclear fuel. According to their respective agreement, the recipient nation would return their spent fuel to the nation of origin and pledge not to develop uranium-enrichment or spent fuel reprocessing facilities. If GNEP had to succeed, the U.S. government would have had to develop the largest reprocessing plant in the world – large enough to serve the equivalent of all 103 commercial reactors in the country.[193] The reality of the existing nuclear technology measures and GNEP's invasive protocols made it impossible to implement nuclear policies at that time, as it was a hastily conceived program that did not live up to its hype. Furthermore, the price tag of setting up GNEP facilities and programs would have been around $100 billion, and U.S. Congress would see that as a major hindrance in pushing the project forward. Another major hurdle for the NRC was not having an established deep geologic high-level RNW repository. Finally, in 2009, the aforementioned ad-hoc and schedule-driven changes made by various U.S. administrations regarding the spent fuels/plutonium reprocessing came to a complete halt, when President Barack Obama defunded the commercialization of the nuclear reprocessing.

Theoretically, spent fuel is the "ore" for fuel-cycle plutonium which is a resource that needs to be managed while it also could be a source for proliferation at the back end of the fuel cycle. The spent fuel contains radioactive waste products produced during the reactor operations and it is considered high-level nuclear waste that needs to be disposed as extremely hazardous materials.[194] The spent nuclear fuel is extremely hazardous because at the time of the removal of the uranium fuel rods from the nuclear reactor, the radioactivity is exponentially more than when uranium fuel rods were placed into the reactor. The radioactivity in the newly extracted fuel rods is so intense that if they are left outside in the open air, the metal surrounding the nuclear material would melt or self-ignite. As a safety procedure, the spent fuel rods are immersed into a pool of water to cool them and to block the radiation. It is estimated that the heat output drops by 99 percent in the first year and by another factor of 5 by the time the spent fuel is 5 years out, and it is still extremely hot.[195] The nuclear reactor operators let the fuel rods sit securely inside the water pools for some years. After they are sure that the fuel rods have become less radioactive and they are not as hot as they were earlier, then they are shipped to a disposal site, or they are shipped to a reprocessing plant. According to the NRC, spent fuel heat and radioactivity decreases over time. It is safe to assume that after 40 years in storage, the spent fuel radioactivity will be about a thousand times lower than

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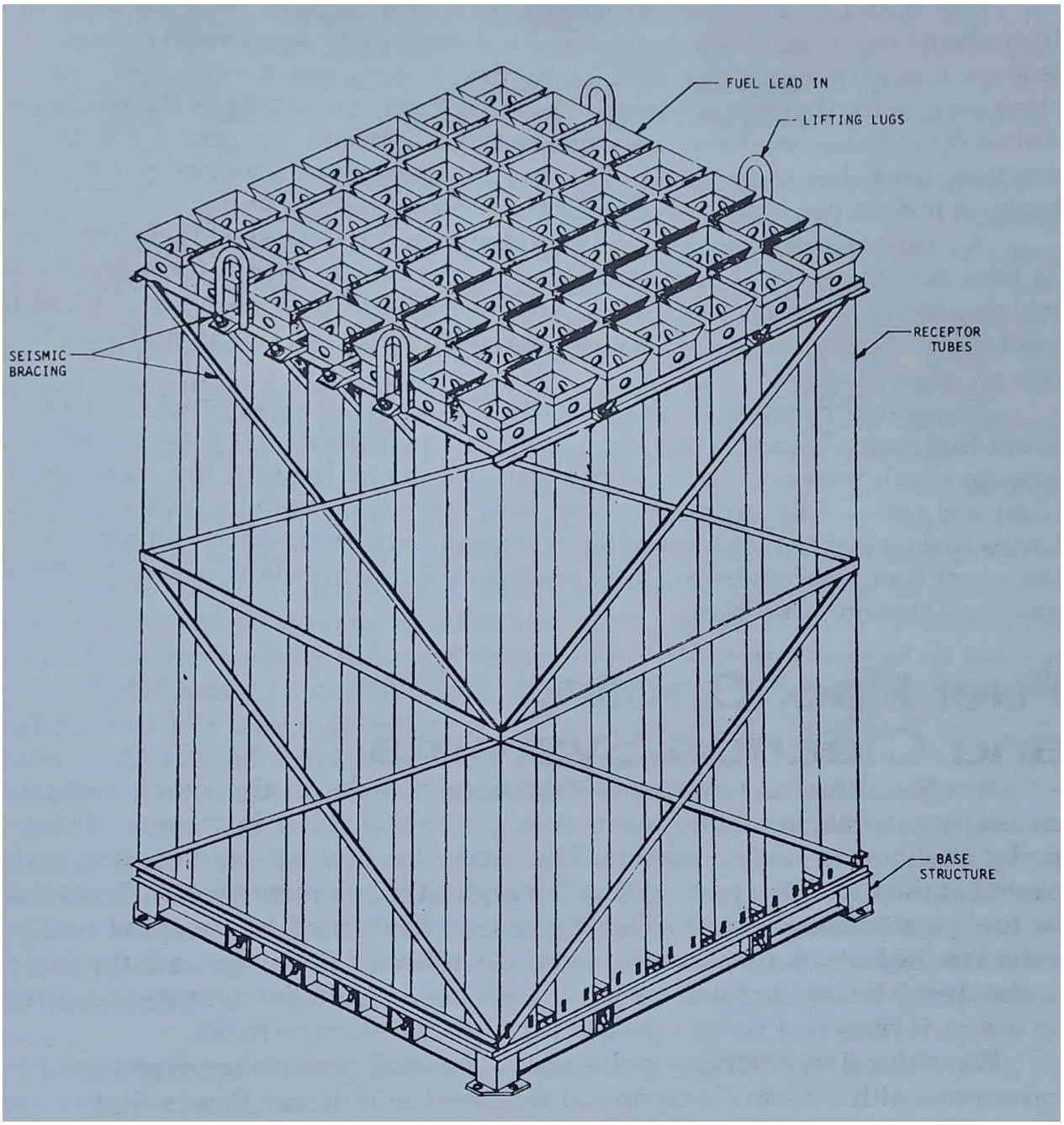
[192] Alley, *Too Hot to Touch,* 108.
[193] Ibid., 108-109.
[194] Gene I. Rochlin, *Plutonium, Power, and Politics: International Arrangements for the Disposition of Spent Nuclear Fuels* (Berkeley, University of California Press: 1979), 235.
[195] Alley, *Too Hot to Touch,* 88.

when it was permanently removed from the reactor. At the last stage, the high-level waste is vitrified or converted into glass which still has many other technical issues and problems, as there are other elements in small amounts that are considered insoluble, and these elements are found at the




David A. Lochbaum, *Nuclear Waste Disposal Crisis* (Tulsa: PennWell Books, 1996), 59.
Figure 3.2 – Spent Fuel Rods in a Rack

bottom of the storage tanks. Liquid RNW contains a higher level of strontium while solid RNW has a higher concentration of cesium than liquid. Both strontium and cesium are high-yield fission products that are present in the storage pond waters of the nuclear reactors. The issue at hand is the variety of elements in the RNW that are in question that makes them nearly impossible to be classified for storage and disposal purposes. Furthermore, due to the nature of these RNW being multifaceted, the classification of these elements has been a source of litigation; the State of Idaho considers them to be in the high-level waste category, while the DOE considers them to be a mixed transuranic waste. Later, the RNW is disposed of in a high-level waste disposal facility.[196] However, the classification of RNW was one of the most troublesome issue nuclear industries were facing.

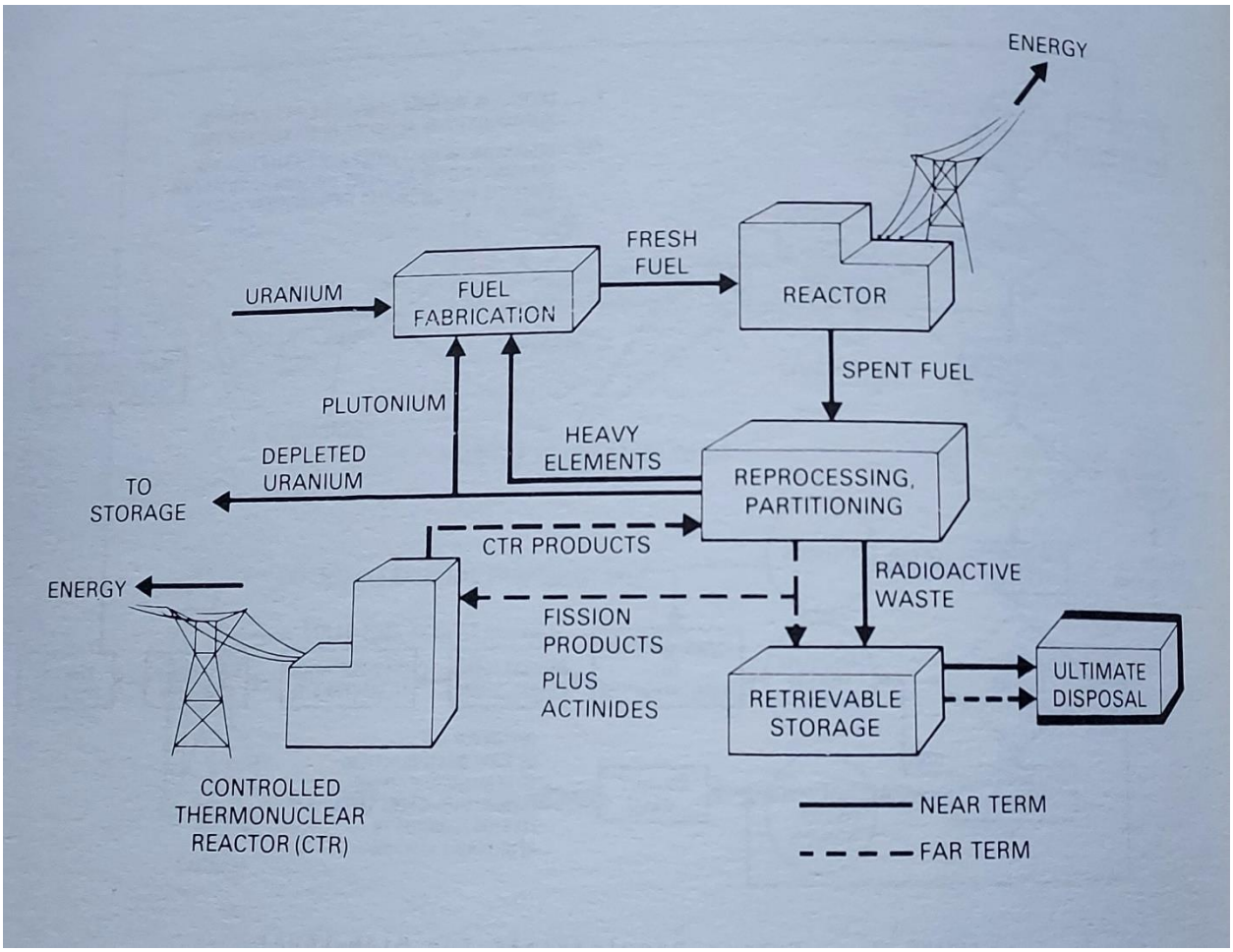



Figure 3.3 – Fuel Cycle from Nuclear Energy Production to Disposal

[196] International Atomic Energy Agency, "The Nuclear Fuel Cycle: From the Mining of Uranium to the Disposal of Nuclear Waste," Vienna, Department of Nuclear Energy, 6. Accessed on 09/12/2022, www.iaea.org.

Although the nuclear power industry was facing many technical and geological issues regarding the ever-growing volumes of high-level RNW but at the same time they were enjoying the nuclear energy boom across the country. First, the nuclear plants ordered in the 1960s became fully operational, secondly, more nuclear energy was being generated in comparison with the oil-fired reactors. Later, in the 1980s, nuclear power plants ordered in the 1970s became operational. In 1983, nuclear power was generating more power than natural gas. Soon after that milestone, nuclear energy surpassed the production of hydro-power energy. In 1994, there were 109 commercial nuclear reactors with a combined generating capacity of 100,000 MWe, which was over 20% of the total electricity output in the country.[197] However, the optimistic growth and progress of nuclear electricity generation considerably slowed down after the nuclear power plant accident at the Three Mile Island Unit 2 (TMI-2). On March 28, 1979, at Harrisburg, Pennsylvania the TMI-2 suffered a reactor core meltdown for the world to view. This accident uncovered substantial problems in design, training, procedural adequacy, emergency planning, crisis management, post-accident assessment, and plant response to a severe accident. [198] The aftermath of TMI-2 accident also brought forward many voices against nuclear energy due to aforementioned various safety and administrative issues. Although the nuclear energy industry was dependent on the market, it could not afford to have the regulation reforms in light of the TMI-2. More specifically, the nuclear industry was not doing well economically before the TMI-2, as there was no new commercial nuclear power plant order placed after 1973, while the cancellation of orders kept on piling up into the 1980s. As the nuclear industry was facing unsympathetic utility regulatory restrictions, while electricity growth projections were not very optimistic and there was surplus electricity available in the market.[199] The debris of TMI-2 and other elements were shipped to the INL after six years of cleaning, research, and analysis. Furthermore, at the time, U.S. nuclear waste policies created uncertainty which had to be addressed in a comprehensive manner.

The reorganization of the AEC was spelled out in the Energy Reorganization Act of 1974 signed by President Gerald Ford which created the Nuclear Regulatory Commission (NRC). Senator Abraham Ribicoff, the primary author of the ACT said about its purpose:

> The development of the nuclear power industry has been managed by the same agency responsible for regulating it. While this arrangement may have been necessary in the infancy of the atomic era after the World War II, it is clearly not in the public interest to continue this special relationship now that industry is well on its way to becoming among the largest and most hazardous in the Nation. In fact, it is difficult now to determine…. where the Commission ends, and the industry begins.[200]

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[197] David A. Lochbaum, *Nuclear Waste Disposal Crisis* (Tulsa, Oklahoma: PennWell Books, 1996), 10-11.
[198] Lochbaum, *Nuclear Waste Disposal,* 11.
[199] Ibid., 10-11.
[200] Ibid., 10.

The newly created NRC was headed by five commissioners, all appointed by U.S. President, and the Commission was responsible for the regulation of the nuclear power industry that included protecting the public health and safety from the hazards of nuclear power plant operation without the conflicting obligation of promoting nuclear energy.[201] The Act also abolished the Joint Committee on Atomic Energy. The 1970s and 1980s are remembered as the decades that brought multiple initiatives, legislations, and presidential interventions to solve the problem of nuclear wastes permanently. First, in 1976, Exxon Nuclear Corporation filed an application for the construction of Nuclear Fuel Recovery and Recycling Center in Oak Ridge, Tennessee. The proposed facility would have reprocessed 1,500 metric tons of nuclear waste per year and later it could have been expanded to a capacity of 2,100 metric tons a year. The permit for the construction of the plant was never issued due to U.S. government's commitment to the Nuclear Non-Proliferation Treaty.[202] In this regard, President Gerald Ford announced on October 28, 1976 that "I have concluded that the reprocessing and recycling of plutonium should not proceed unless there is sound reason to conclude that the world community can effectively overcome the associated risks of proliferation."[203] Although the proliferation of the RNW was a real threat but there were many political, economic, and administrative issues that also weighed upon nuclear waste issues.

Later, President Jimmy Carter tried following his predecessor's footsteps to further strengthen the U.S. stance on the Nuclear Non-Proliferation Treaty by stating that "First, we will defer indefinitely the commercial reprocessing and recycling of the plutonium produced in U.S. nuclear power programs."[204] This decision meant that no further funds were going to be provided for the under-construction reprocessing plant at Barnwell in South Carolina. Nevertheless, in 1981, President Ronald Reagan lifted the ban on commercial reprocessing, however, the uncertainty about plant financing and unfavorable regulatory environment discouraged most private businesses and states. Later, in 1982, the Nuclear Waste Fund (NWF) was established to cover the cost for the disposal of fuel assemblies that are high-level RNW, however, the NWF proved insufficient to cover the disposal cost of the fuel assemblies or reprocessing of the fuel assemblies. The cycle of reprocessing of the fuel assemblies was considered the best solution in reducing the radioactive half-life of the RNW before being delivered for disposal into a permanent geologic repository.[205] Due to the lack of a comprehensive and well-defined waste management program, the U.S. ban on commercial reprocessing still haunts the nuclear power industry as they are struggling to find permanent nuclear waste solutions. The National Research Council noted that "The Department of Energy has about 100 million gallons of liquid HLW (High-level waste) stored in underground tanks at its Savannah River and Hanford Sites and about 4,000 cubic meters of solid HLW stored in bins at the Idaho Site." Furthermore, "The Department estimates that it will spend on the order of $50 billion over the next 50 years or so to put this waste into a more

[201] Ibid.
[202] Ibid., 74.
[203] Ibid., 75.
[204] Ibid.
[205] Ibid., 76.

stable form for shipment to a geological repository."[206] Again, there is no way to find out if the 100 million figure issued is an actual number of high-level RNW stored in various nuclear sites including the INL. Idaho residents are skeptical of the government's accounting of the RNW at the INL and their storage and disposal policies because all their measures are for temporary purposes.

## Temporary and Comprehensive Nuclear Waste Policies

In 1982, President Ronald Reagan signed the Nuclear Waste Policy Act (NWPA) that provided a comprehensive framework for the disposal of the spent fuel assemblies and high-level RNW generated from commercial reprocessing or defense sources. The NWPA gave DOE the responsibility to design, construct, and operate one or more repositories. In addition, the ACT gave the Environmental Protection Agency (EPA) responsibility to develop standards for the protection of environment and the measures of radioactivity inside and outside the repository. The ACT specified that each repository would have a maximum capacity of 70,000 metric tons of spent fuel assemblies and high-level RNW. Furthermore, the NWPA established year 1998 as its goal for the opening of the first permanent geologic repository. The DOE would collect a fee of 0.1 cent for every kilowatt-hour of electricity generated by the nuclear power plants, which would be paid into the NWF to finance the siting, construction, and the operation of the repositories.[207] The utility owners started contributing to the NWF by 1983, and 34 states had paid over $8.5 billion by December 1994. The NRC concluded after five years' worth of research that the best option for spent fuel assemblies was the disposal into a deep geologic repository. Secretary of Energy Donald Hodel confirmed DOE's responsibility to accept spent fuel assemblies beginning in January 1998, whether or not a permanent disposal facility was ready. Secretary Hodel said that "This should enable utilities to plan for their projected waste disposal needs with confidence and certainty."[208] Later, three sites were selected out of nine candidates for the first geological repository, and they were Yucca Mountain, Deaf Smith County, and the Hanford site in Washington state.

In 1986, the DOE announced that it was postponing the second geological repository program due to the declining projections of spent fuel inventories and high cost in preparing a second repository site, although the DOE had already spent $63.5 million for the siting program. Furthermore, in 1987, President George Bush signed the Nuclear Waste Policy Amendment ACT that directed the DOE to evaluate only the Yucca Mountain site as the first selected repository for high-level RNW. The ACT also required the phasing-out of site-specific activities at all other candidate sites and DOE would continue to have a 70,000 metric tons limit on the amount of spent fuel assemblies and high-level RNW for its first repository.[209] In 1995, the DOE officials stated that they

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[206] National Research Council, *Research Needs for High-Level Waste: Stored in Tanks and Bins At U.S. Department of Energy Sites*, Environmental Management Science Program, Board on Radioactive Waste Management (National Academy Press, Washington, D.C. 2001), 7.
[207] Ibid., 81.
[208] Ibid., 82-83.
[209] Ibid., 84.

could no longer felt obligated to accept spent fuel assemblies by the year 1998. They opined that due to the delay in the establishment of a geologic repository, they could not be held responsible for the disposal of the spent fuel assemblies because there were no interim federally controlled storage/disposal location[s]. The DOE, in order to finish the repository project on time, wanted to recalibrate their estimated goal of opening the first repository from 1998 to the year 2003. However, after working for seven years and spending over a billion dollars, the DOE reported that it was still 21 years from achieving its goals. The utilities continued to pay into the NWF as required by their contracts with the DOE, however, the availability of the geological repository for high-level RNW was decades away. The DOE first identified the Nevada Test Site Area (NTSA) as the potential acceptable site for a geologic repository in 1976, which is about 85 miles northwest of City of Las Vegas, Nevada. In order to gather data and research material for the first project analysis, the DOE officials placed 11 spent fuel assemblies in the Climax Mine at the NTSA for about three years. The NTSA site is located on granite formations, so it did not fracture from the decay heat emitting from the spent fuel assemblies. The 11 fuel assemblies were removed from the NTSA in 1983 and returned to their temporary storage, and the experiment was considered a success by the DOE officials because fuel assemblies were successfully stored underground for about 1,000 days and then they were retrieved without any issues.[210] Later, in February 1983, the DOE identified Yucca Mountain as the Study Experiment Site for a geologic repository. Later in the paper, more information and analysis regarding the Yucca Mountain project will be discussed.

The Low-Level Radioactive Waste Policy Act of 1980 mandated compact agreements negotiated by states in all regions, and a local low-level RNW burial ground is agreed upon. In 1981, the Northwest Interstate Compact on Low Level Waste Management was submitted to Congress that included seven states. David Stevens, a spokesperson for Governor Spellman of Washington said in this regard that "We're urging Congress to take quick action on these compacts when they come in," furthermore "If you want a system in place, one of the ways would be to ratify the first compact. That's a clear signal to the other areas that they going to have to do something."[211] However, no Congressman was willing to approve a compact in a different area other than their own constituency because that would mean that they are shutting off revenue from their own state. In 1983, Rocky Mountain compact was introduced, Wyoming Senator Alan K. Simpson gave high marks to the states involved. He said that "I do want to congratulate all of those within the Rocky Mountain region who worked so long and diligently to pull this compact together."[212] Oregon Senator Marl O. Hatfield congratulated the Northwest states when their compact was reintroduced in Congress early in 1983. "This compact, which has gone through a great deal of discussion in the affected states, deserves to be ratified by Congress," furthermore "It is a good-faith effort, in my opinion, in recognizing a serious problem, and working out a framework for these states to begin negotiating a suitable low-level radioactive waste disposal site."[213] By

[210] Ibid., 85.
[211] Barlett, *Forevermore*, 238.
[212] Ibid., 239.
[213] Ibid., *Forevermore,* 239.

August 1983 six regional groups: the Northwest, Southeast, Midwest, Central, Northwest, and Rocky Mountain regional compacts had been negotiated and ratified by their respect state legislators. Wyoming Senator Malcolm Wallop summed up the compact situation in October 1983 by stating that "These compacts reaffirm the states' rights and reinforce the role states will play in solving many of the problems which face us today."[214] In reality, small states had isolated large states and even denied membership in a compact. Washington state had exempted California from the Northwest compact. Senator Henry M. Jackson of Washington said in this regard that "This regional approach is necessary because few states generate sufficient low-level waste to justify on an environmental or economic basis the opening of a separate site within each state for a disposal facility."[215] Although the U.S. Congress had not yet approved any compacts but there were differences within various state legislators/agencies that were starting to appear.

The States of Nevada and South Carolina had already started to limit access to their nuclear dumps. First, Nevada introduced new packaging guidelines in December 1980, which reduced the volume of low-level RNW by 88 percent at their low-level nuclear waste disposal facility at Beatty, where the volume fell from 450,000 cubic feet to 53,000 cubic feet. Second, Barnwell, South Carolina in 1982 introduced volume reduction measures that caused the volume to go down by 37 percent, from 1.9 million cubic feet to 1.2 million cubic feet.[216] Besides, man-made hurdles there were natural hurdles and geological issues that were taking a toll on compact system and its implementation. In the Northeast, there is high rainfall and high population density, which could result in political ramifications for its elected officials for attempting to set up a radioactive dump. Although New York state was the biggest generator of low-level RNW in its compact, but no legislators were willing to establish a nuclear dump in their territories. New York state had an acting disposal site, however, New York state was not interested in being the designated disposal site. John Dingell, Congressman from Michigan opined in this regard that "There is presently a critical shortage of low-level waste disposal sites, and the lack of such a facility in the Northeast, which is the largest generator of such waste, cannot be ignored. The enactment of this legislation should, therefore, provide a substantial incentive to the State of New York to consider the potential use of this site for meeting regional needs."[217] Besides the state of New York, Pennsylvania was considered the second largest producer of low-level RNW because two of its nuclear plants went online in 1985. However, Pennsylvania did not want to volunteer it services/site as a regional RNW site for a compact. The Pennsylvania State University study showed that Northwestern Pennsylvania, in Erie and Crawford counties had a stratum of rock known as the Hiram Till consists of clay-rich tills offering a "desirable combination of conditions" for waste burial. Second, was the Bradford County region that was "favorable for dispensing radioactive leachates in the sub surface." Finally, Southeastern Pennsylvania/Gettysburg and Quakertown region was a "potentially

[214] Ibid.
[215] Ibid., 240.
[216] Ibid., 240-241.
[217] Ibid., 243-244.

favorable region for radioactive waste storage and disposal."[218] However, the history of RNW management and disposal in shallow trenches or emplacement of RNW in the pits that were earlier designated suitable for safe burial by nuclear experts later turned out not be the case. In 1984, the Northeast compact began to unravel because New York State's Energy office released a study that recommended it not to join the compact. The study specified that the "New York State should neither seek to renegotiate the specific provisions of the proposed eleven-state" compact and furthermore that "nor pursue any form of an eleven-state low-level radioactive waste compact."[219] Instead the study urged State of New York to negotiate with one or more Northeast states to organize another compact to be submitted to the legislature in 1985. Governor Cuomo of New York state did not join the northeast compact based on this study. Later, the State of Pennsylvania pulled out of the eleven-state compact to pursue a new agreement with its neighbors. Pennsylvania Governor Dick Thornburgh explained their stance: "Pennsylvania is prepared to do its share, but we are not prepared to accept sole responsibility for all the low-level radioactive waste produced in the Northeast."[220] Under the circumstances West Virginia and Pennsylvania might want to form a new compact, while Maine was still studying above-ground storage at the Maine Yankee nuclear power plant at Wiscasset.

Of all regions, the Northeast region has had the most difficulty in forming a compact. There were serious inequalities in the generation of low-level RNW amongst various states. Massachusetts probably produces the most amount of commercial low-level RNW while New Hampshire produces the least. Maine, Vermont, New Hampshire, Rhode Island, and Delaware only produce 5 percent of the Northeast's waste. While the biggest producers of waste are Pennsylvania, New York, New Jersey, Connecticut, and Maryland that are 95% of low-level waste generators.[221] The smaller states wanted an exemption from having a land burial site within their territories. In this regard, Ednapearl F. Parr, a state representative from Maine noted that "All the big states want to dump on Maine, New Hampshire, and Vermont," furthermore that "They think we are very sparsely settled and a bunch of country hicks. When people say it's less populated, to hell with them."[222] The larger states were equally disillusioned with the compact forming measures and restrictions. Robert Kurtter, a New York State legislator said that "They have done an inadequate job of dealing with the catastrophic-accident-long-term-liability question. Right now, if there is an accident and it goes beyond the stated insurance limits, it is the host state's responsibility. I can't see any incentive for a state to assume that risk unless everybody else in the region is going to be a party to it."[223]

The NRC was still pushing the policy of continuation of shallow-land-burials of RNW in all states, however, they were facing a significant push back from most states. In 1984, Dr. Judith H. Johnsrud of the Network and Public Policy Group summed up the

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[218] Ibid., 244-245.
[219] Ibid., 245-246.
[220] Ibid., 246.
[221] Ibid., 231.
[222] Ibid., 234.
[223] Ibid., 234-235.

situation, by stating that "Many in the Northeast, having studied the history of shallow land burial, conclude that near-surface trenches, even those which conform to [current] Nuclear Regulatory Commission … standards, are not an adequate means of LLRW [low-level-radioactive-waste] isolation."[224] Most states preferred to have an above-ground engineered facility which was considered best method to isolate the wastes. However, the comparison between the rainy weather and the availability of isolated land was constantly being brought up by U.S. officials, state officials, and the industry insiders. Joanne Buehler, an official of U.S. Ecology, the company that manages the Richland and Beatty dumps, in 1982 said in this regard that "They look around at these arid sites, and they're beautiful, geologically, hydrologically, they're absolutely gorgeous sites we operate. And of course, the capacity is there. And they [in the East] just don't understand why they should be having to go through this hassle when this is available."[225] Beatty is about 100 miles from Las Vegas in the desert which receives about four inches of rain a year. While the Northeast region receives about thirty-five inches of rain a year. The NRC is still pushing for shallow land burial while they have ignored above ground and engineered storage facilities. The Public utilities and nuclear power plant operators are already making arrangements to expand their respective storage facilities for wastes. The NRC spokesperson noted in this regard that "it turns out that something on the order of two-thirds of all utilities in the country have made some kind of change to accommodate more waste storage," furthermore that the accommodations "may run anywhere from putting something in a back room to building a big facility, so there's a wide range of changes that have been made, depending upon the status of the utility."[226] All the utilities were reluctant to provide a long-term storage of low-level RNW, although they knew that there was no high-level RNW repository available in the country which made their nuclear power plant storage a defacto repository for fuel rods/assemblies. Instead of having six or seven mutually agreed upon interstate compact sites geographically positioned around the country, however, the debate about the low-level waste was starting to focus on having more than a hundred nuclear sites which could nullify the compact idea for a region. Now, the nuclear industry wanted two things for a stable nuclear waste policy, first, a federal timetable to accept the RNW, second, an expectable payment mechanism that would finalize the cost of waste storage and disposal.[227] The U.S. government was not having any success in offering a comprehensive solution to the storage and disposal of the RNW in the country.

## The Waste Isolation Pilot Plant (WIPP)

The DOE expected some realization in getting the deep geologic repository for the transuranic RNW. In 1975, U.S. government announced an agreement with the State of New Mexico to build a $1 billion facility named Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, where they would deposit military transuranic waste. The

[224] Ibid., 248.
[225] Ibid., 236.
[226] Ibid., 249.
[227] Gerald Jacob, *Site Unseen*, 92.

WIPP facility would have 19,000 acres of land and a planned 200 acres of rooms to be carved out of a 3,000-foot-thick salt formation that were some 2,000 feet underground.[228] The establishment of the WIPP project was a good news for the INL, where over 100,000 fifty-five gallon barrels are stored containing military transuranic waste that are waiting for permanent disposal.[229] In this regard, in 1982, the DOE outlined this schedule: "The WIPP facility will dispose of defense transuranic waste stored retrievably at the INEL [INL]. By approximately 1990, all existing waste stored at the INEL [INL] will have been removed to WIPP, and the WIPP facility would be in a position to receive and dispose of transuranic waste from other defense waste generating facilities."[230] The WIPP project was proceeding satisfactorily within the resources and schedule established for it, however, there were reports that U.S. government was trying to change the RNW classification and depository mode. One internal memorandum from the files of Congress's Joint Committee on Atomic Energy stated, "[Federal energy officials] confirmed that consideration is being given to using the Waste Isolation Pilot Plant as the first repository for commercial high-level wastes…. The Governor's committee has been receptive to having a high-level waste repository in the state."[231] Congressman Manuel Lujan Jr. maintained that their administration had taken wait and see attitude. In fact, the WIPP project had started to evolve without the input from the residents of New Mexico, while the DOE recommended the WIPP be used as a "moderate scale demonstration of the capability for ultimate disposal of spent fuel in salt…. Up to 1,000 fuel assemblies…. would be involved."[232] In simple terms, the WIPP facility will be used to deposit high-level RNW along with the moderate military transuranic waste. The positive attitude of New Mexicans towards the WIPP project changed into a protest against the shifting nature of the proposed category and volumes of nuclear waste.

Moreover, the U.S. government desired to have high-level RNW placed at the WIPP facility as an experiment. Later, they also wanted to deposit used fuel rods from the nuclear reactors. In 1977, the General Accounting Office (GAO) noted that the New Mexico facility could "serve the needs of the commercial nuclear industry by becoming the first commercial

[228] Ibid., 148.
[229] Ibid., 63.
[230] Ibid., 150.
[231] Ibid., 149.
[232] Ibid., 149-150.

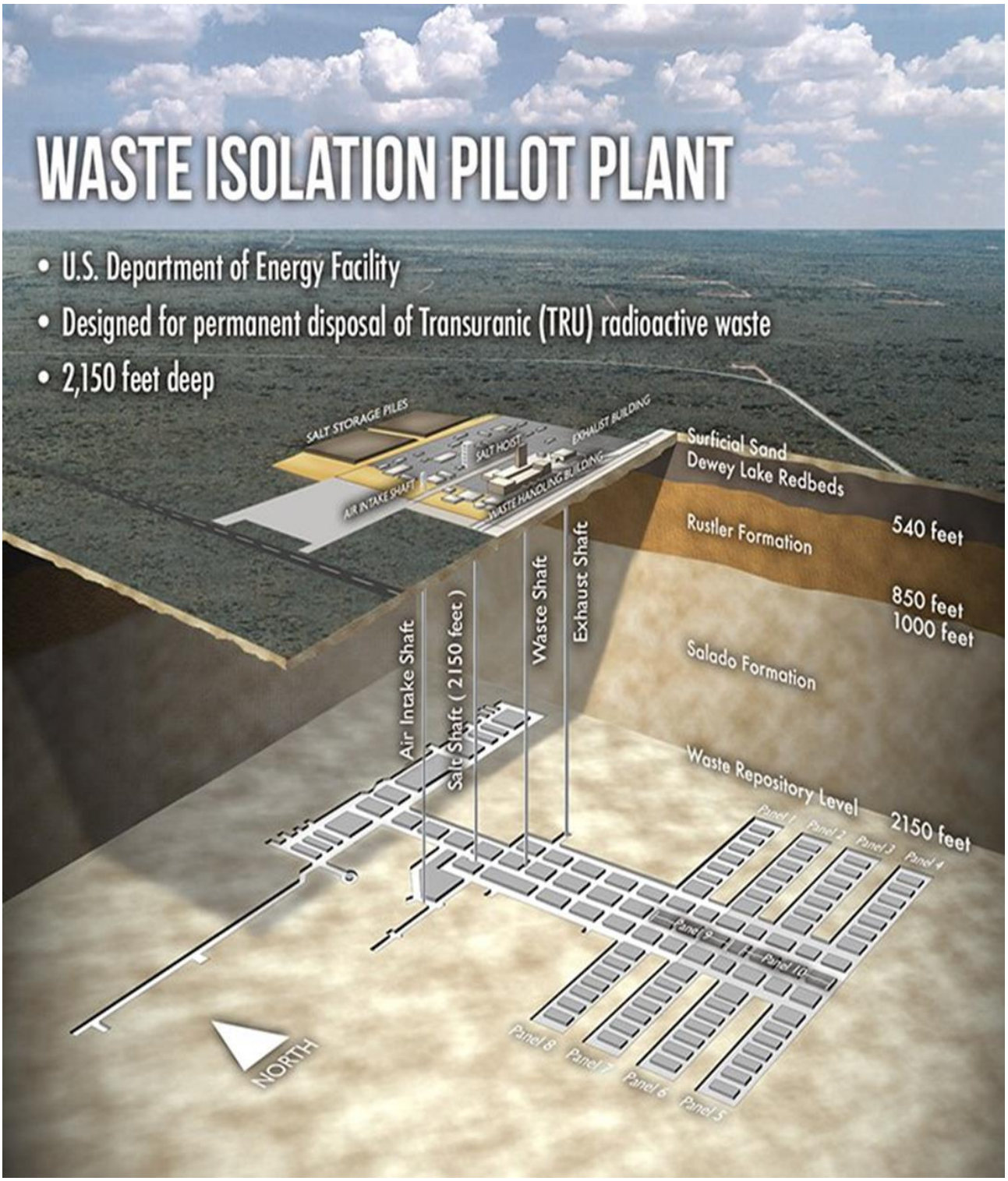


Figure 3.4 - A cross section of the Waste Isolation Pilot Plant repository near Carlsbad, New Mexico. Courtesy of Department of Environmental Management.

waste repository," and that WIPP "may be able to handle all [defense] and commercial high-level and transuranic contaminated wastes through the year 2000."[233] The New Mexico residents felt alienated by U.S. government's authoritative attitude, although State's Congressional delegation had been reassured earlier that they would have a veto power over any federal repository, however, there was no signed legislative bill or authority providing them that right. Later, in 1979, U.S. Congress passed a law instructing DOE to negotiate an agreement with New Mexico, spelling out the State's rights and authority in the WIPP approval process. But federal energy officials refused to negotiate, forcing the State to file a lawsuit to compel them to do so. In addition, U.S. government officials gave the impression as if WIPP project had been confirmed as a permanent repository, whereas, earlier, they had described it to be a test facility. More specifically, the congressional legislation described WIPP as "a research and development facility to demonstrate the safe disposal of radioactive waste resulting from the defense programs."[234] Since the U.S. Congressional legislation described WIPP as a research facility, the U.S. government's switch was an unexpected variation in nuclear waste policy, which was unacceptable to the New Mexicans. In addition, U.S. officials started mentioning WIPP project as the confirmed RNW facility in the west, which raised questions about the integrity of the federal testing program. Many New Mexicans speculated if the U.S. government had used testing facility concept as a smokescreen to get their consent for the WIPP project.

The government told the agency that WIPP "may be able to handle all [defense] and commercial high-level and transuranic contaminated wastes through the year 2000."[235] The New Mexico residents felt alienated by U.S. government's authoritative attitude, although State's Congressional delegation had been reassured earlier that they would have a veto power over any federal repository, however, there was no signed legislative bill or authority providing them that right. Later, in 1979, U.S. Congress passed a law instructing DOE to negotiate an agreement with New Mexico, spelling out the State's rights and authority in the WIPP approval process. But federal energy officials refused to negotiate, forcing the State to file a lawsuit to compel them to do so.[236] In addition, U.S. government officials gave the impression as if WIPP project had been confirmed as a permanent repository, whereas, earlier, they had described it to be a test facility. More specifically, the congressional legislation described WIPP as "a research and development facility to demonstrate the safe disposal of radioactive waste resulting from the defense programs."[237] Since the U.S. Congressional legislation described WIPP as a research facility, the U.S. government's switch was an unexpected variation in nuclear waste policy, which was unacceptable to the New Mexicans. In addition, U.S. officials started mentioning WIPP project as the confirmed RNW facility in the west,

[233] Barlett, *Forevermore*, 151.
[234] Ibid., 150.
[235] Ibid., 151.
[236] Ibid., 150.
[237] Ibid.

which raised questions about the integrity of the federal testing program. Many New Mexicans speculated if the U.S. government had used testing facility concept as a smokescreen to get their consent for the WIPP project.

## Site Selection of a Repository in a State

The WIPP project could only accommodate transuranic RNW from defense facilities, while the U.S. government was still trying to establish a geologic repository for the high-level RNW from nuclear energy power plants. A desirable site will have a low local population density, sufficient available surface water (or, in some cases, the absence of it) and sub-surface formations that provide security in case of accident.[238] The U.S. government's efforts in establishing a high-level repository had not produced good results. Later, in 1982, U.S. Congress passed the Nuclear Waste Policy Act (NWPA) that provided a roadmap for the federal government to establish a geologic repository for permanent storage and disposal of RNW from civilian nuclear power plants. The NWPA established procedures and a detailed schedule for the selection, construction, and operation, and general operations of two permanent high-level waste repositories…. To finance the repositories, the NWPA created the Nuclear Waste Fund, which levied a user fee of 0.1 cent per kWh on the consumers of electricity. The NWPA was drafted to establish two high-level RNW repositories, although no state was interested in having one in their territory.[239] The U.S. government acknowledged that they had committed mistakes in the past trying to solve the waste storage and disposal issues. More specifically, the Carter administration admitted that there were gaps in the scientific understanding of the long-term environmental effects of radioactive waste disposal.[240] The acknowledgement of policy failure by the U.S. government to comprehensively deal with the RNW issue is considered a turning point in the nuclear waste industry. In order to prove their resolve, U.S. government sought to improve and strengthen the current laws to provide a permanent solution to the ever-growing problem of high-level RNW. The U.S. government wanted to implement the NWPA to demonstrate once and for all that they had established a federal policy for the disposal of spent fuel and high-level RNW. After a thorough search across many regions deemed suitable to have a high-level repository, the DOE came up with six states including Louisiana, Mississippi, Nevada, Texas, Utah, and Washington. Later, in 1985, the DOE presented a smaller list of three sites in the states of Texas, Washington, and Nevada to President Ronald Reagan. However, the respective state officials and congressional delegations protested against inadequate site assessments and technical analysis. Most importantly, the DOE was unsuccessful in identifying a possible repository site in the east, and in 1986, they gave up on having a repository site in the east.[241] The search for a repository by the U.S.

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[238] Rochlin, *Plutonium, Power, and Politics: International Arrangements*, 205.
[239] Robert J. Duffy, *Nuclear Politics in America: A History and Theory of Government Regulation* (Lawrence: University Press of Kansas, 1997), 186.
[240] Robert Stobaugh & Daniel Yergin, *Energy Future: Report of The Energy Project*, 160.
[241] Duffy, *Nuclear Politics in America*, 186.

government had ended in the east, but a search for a geologic repository in the west continued, while ideas that were previously discarded were also entertained. Idaho Senator James McClure said that "to omit the second repository would be breaking faith with western state senators. These senators had been promised that the West would not get all of the high-level nuclear waste generated in the country."[242] This was a serious breach of trust by federal government, as they made promises to the officials in various Western states that the U.S. government was serious about having a repository in the east. In 1985, President Reagan concluded that the defense high-level waste would be disposed of in the repository that was being developed for the civilian waste.[243] This was considered another form of broken promise where the U.S. government was trying authoritatively to push down their agenda of storing/disposing high-level RNW in the repository for transuranic waste. Also, a monitored retrievable storage (MRS) facility was envisioned that would have stored spent fuel from the commercial nuclear power reactors as a temporary storage, and eventually, once a permanent repository was available, all the high-level waste would be transferred there.

The MRS was considered to be the perfect alternative to a deep geologic repository because it could be established anywhere in the country, since it was not dependent on the local geology and hydrology, and they could establish comprehensive safety measures for above the ground facility. However, the critics of the MRS pointed out the deficiencies in the past procedures and criteria for selecting a site for high-level RNW which were never publicly debated or disclosed, and they demanded that a national screening program be established that would be free from politics and past commitments.[244] Another significant milestone in nuclear waste history happened in the year 1987, which brought an amendment to the 1982 NWPA. More specifically, the U.S. Congress eliminated the program of second repository site selection/identification, and Yucca Mountain, Nevada was considered the most appropriate location for a high-level RNW repository. The MRS facility was also allowed under the NWPA 1987 that was tied to the construction and development of the first repository.[245] President George W. Bush recommended Yucca Mountain site to the U.S. Congress after receiving preliminary findings from pertinent agencies. The NWPA offers the right of disapproval to the state where the repository would be located. In this case, State of Nevada officials filed a disapproval with the U.S. Congress within the specified timeframe, however, it was not approved because the Congressional procedures were not followed within the time of session.[246] Most governors and state legislators were walking a tightrope because they had to certify that they were willing to support a low-level nuclear dump in their territories. New York State Governor Cuomo said that the "process put together by the federal government was neither rational nor fair. And he doubted that members of

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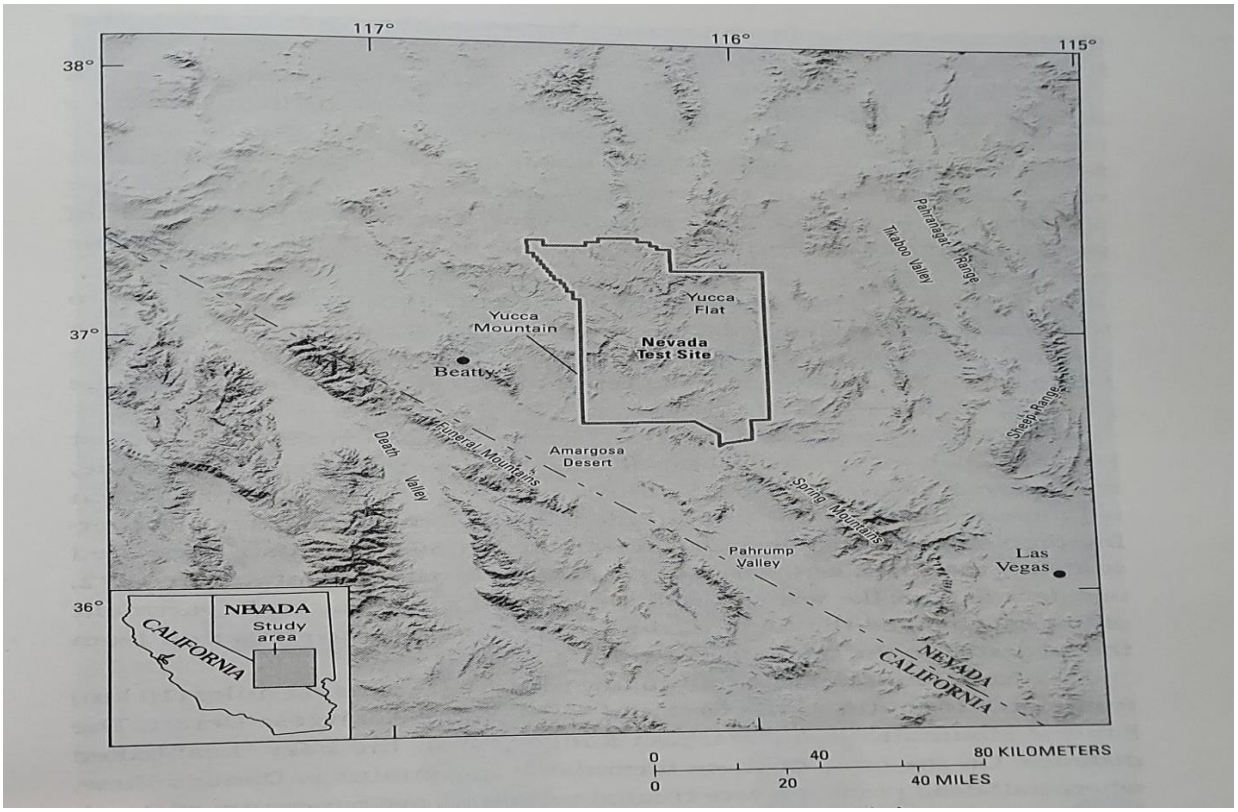
[242] Robert Vandenbosch, *Nuclear Waste Stalemate,* 73.
[243] National Research Council, *Nuclear Wastes: Technologies for Separations and Transmutation* (Washington, D.C. National Academy Press, 1996),15.
[244] Jacob, *Site Unseen*,76-77.
[245] National Research, *Nuclear Wastes*, 15.
[246] Melfort, *Nuclear Waste Disposal*, 2-3.

Congress "understood the problem well when it passed that legislation."[247] Cuomo found serious geographical, hydrological, and logistical issues that weighed down the feasibility of a low-level RNW dump in Alleghany County, a rural New York state region. In 1983, the Wisconsin voters rejected hosting a high-level nuclear waste repository by eight to one margin. This vote in Wisconsin is considered first state referendum on nuclear waste in the United States. The main question on the ballot stated that "Do you support the construction of a national or regional nuclear waste disposal site in Wisconsin?"[248] The question asked was in line with the NWPA guidelines, however, it was roundly defeated by the Wisconsin voters. In Maine, the debate about the closure of Maine Yankee nuclear reactor had reached a fever pitch. DOE officials reminded Maine residents that they had no right to oppose a nuclear waste dump while they were using electricity generated by a nuclear reactor. This [DOE] approach proved to be ineffective, and Maine voters rejected shutting down the reactor while continuing to oppose a nuclear waste repository.[249] There were five bills introduced in the House and two in the Senate calling for elimination of the second repository, which meant that the Eastern states did not want a permanent nuclear repository.




[247] Thomas V. Peterson, *Linked Arms: A Rural Community Resists Nuclear* Waste (Albany: State University of New York Press, 1990), 224.
[248] Robert Vandenbosch and Susanne E. Vandenbosch, *Nuclear Waste Stalemate: Political and Scientific Controversies* (Salt Lake City: The University of Utah Press, 2007), 57.
[249] Robert Vandenbosch, *Nuclear Waste Stalemate*, 57.

Figure 3.5 - Image of Yucca Mountain, Nevada map location

## Yucca Mountain High-Level RNW Repository

In 1980, President Carter announced his radioactive waste policy that the DOE was going to be responsible for preparing a "detailed National Plan for Nuclear Waste Management."[250] Although the DOE published study intended to carry out the President Carter's directive while conceding that there were many procedural and technical questions surrounding the radioactive wastes permanent solution. By early 1981, DOE had identified eight salt formations that had the potential of serving as a permanent repository. Later, in 1981, Secretary of Energy James B. Edwards announced President Ronald Reagan's nuclear policy, he said that the growth of nuclear energy has been hobbled by a "morass of regulations that do not enhance safety," and by the failure of the federal government "to work with the industry to develop an acceptable system for commercial waste disposal."[251] The Reagan administration reversed the commercial reprocessing ban that the Carter administration had imposed. Although there was some optimism about the aforementioned reversal action by the Reagan administration, however, the owners of Barnwell reprocessing facility in South Carolina conceded that nuclear fuel reprocessing might not be commercially practicable.[252] In December 1982, U.S. Congress passed the Nuclear Waste Policy Act, which was considered a comprehensive bill that would have provided a predictable road map for the establishment of permanent repositories for the nuclear wastes. Moreover, the legislators agreed upon the inclusion of the defense wastes along with the commercial RNW, and the DOE would develop unified system if separate facilities were not available.

Louisiana Senator J. Bennett Johnson pushed for monitored retrievable storage as a long-term approach to the high-level waste problem because DOE was investigating salt domes in northern Louisiana as a possible site for a high-level waste repository. He argued that monitored storage vaults could be safely placed "in any State in the continental United States," and suggested that "tunnels built for nuclear weapons tests in Nevada might offer an auspicious setting."[253] However, the main problem DOE was facing with no interest on any of states to volunteer their territories for a repository site. In 1987, an amendment to the Nuclear Waste Policy Act was passed that required DOE to conduct environmental evaluations of possible sites and select five leading candidates. Secretary of Energy John S. Herrington announced that three final choices for a site have been finalized, and they were Deaf Smith County, Texas; Yucca Mountain, Nevada; and Hanford, Washington. Later, an amendment as a part of budget bill was passed that stopped all work on Deaf Smith County and Hanford sites and directed DOE to conduct exploratory investigations at Yucca Mountain.[254] Nevada officials immediately opposed

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[250] J. Samuel Walker, *The Road to Yucca Mountain: The Development of Radioactive Waste Policy in the United States* (Berkeley: University of California Press, 2009), 170.
[251] Walker, *The Road to Yucca Mountain,* 173.
[252] Ibid.
[253] Ibid., 177-178.
[254] Ibid., 182-183.

the development of the Yucca Mountain site, furthermore, they took several legal, political, and public-relations measures to block DOE actions. By 2001, DOE had spent about 4.5 billion to build tunnels and drill bore holes at a thousand feet under the surface at Yucca Mountain. In 2002, Secretary of Energy Spencer Abraham recommended to President George W. Bush that Yucca Mountain be constructed as the nation's first high-level waste repository. President Bush immediately approved Abraham's recommendation, however, Kenny Guinn, Governor of Nevada protested against the DOE's judgment was not based upon "sound science and common sense," and he vetoed the selection of Yucca mountain. However, within a few weeks both Houses of Congress gave the Yucca Mountain project a green light by voting to override Guinn's veto.[255] However, there were many design, and technical issues remain unsolved.

The Yucca Mountain is located in the southwestern Nevada, approximately 100 miles northwest of Las Vegas. It only receives 7.5 inches of rainfall per year, it is an arid location, and the proposed burial tunnels in the mountain range are part of volcanic tuff. The tuff is fractured in many areas, and the fractures provide the principal path for surface water to reach the emplaced waste. The movement of water through the aquifer is also primarily through fractures.[256] In addition, there have been several earthquakes in the area. In 1999, there was a magnitude 4.7 earthquake 28 miles east of the repository. Later, June 2002, there was a magnitude 4.4 quake 12.5 miles southeast of the site. There have been several earthquakes near the site area that establishes the theory of Yucca Mountain site being in an earthquake zone. The Yucca Mountain is located in the Nye County, a large sparsely populated area that is only 7 percent privately owned.[257] Many Nevada residents and politicians were opposed to having a high-level RNW repository in their state due to distrust of DOE they had built up over the years. There had been 829 tests of atomic and thermonuclear weapons at the Nevada Test Site between 1952 and 1992. The radioactive fallout from the nuclear bomb tests exposed many residents in Nevada to cancer and other serious illnesses. Moreover, the Nevadans dreaded importing more RNW into their state because DOE had a checkered record in terms of management of defense nuclear wastes. In addition, the Nevada residents were not compensated for the diseases/illnesses they received from radioactivity. Most Nevada residents were satisfied that they have performed their national duty by hosting the nuclear weapons tests and that it is unfair to ask them to do more.[258] More specifically, the Nevadans were concerned about the economy of their state that relied heavily on the gaming/entertainment industries, which would be adversely affected if there was an RNW accident at the Yucca Mountain repository. In 2001, there were 35 million tourists that visited Las Vegas and Reno, who spent $39 billion in these areas, and the State of Nevada levies 6.25 percent tax on gambling, making it the chief source of revenue for the state government. In 1979, the Three Mile Island nuclear reactor core melt down caused 200,000 Harrisburg, PA residents to leave the area temporarily, which could be a nightmarish scenario for the Nevada residents who are dependent on the jobs in gaming/entertainment industries. If

[255] Ibid., 183.
[256] Robert Vandenbosch, *Nuclear Waste Stalemate,* 105.
[257] Ibid., 115-116.
[258] Ibid., 117.

the tourists were turned away from their cities that would have disastrous economic consequences for the State of Nevada.

The Nevada state authorities have focused on the potential problems with the repository site at the Yucca Mountain. They refer to the possibilities of earthquakes, volcanic activity, hydrothermal activity, and leakage of water through fractures in the rock that would hold the repository. All the problems aside, in 1979, Department of Energy spending in the State of Nevada was approximately $357 million that far exceeded the Defense Department's $334 million that was equivalent to nearly $450 per state resident.[259] Many locals supported existing and additional nuclear projects in the area. The U.S. Congress made things worse by attaching the availability of federal funds to the State of Nevada only if they relinquish their right to a veto over the Yucca Mountain project. After the passage of the bill known as "Screw Nevada Bill" sponsored by Louisiana Senator Bennett Johnston, there was little incentive for the Nevada officials to cooperate with the federal officials and project management. Later, in 1989, the Nevada legislators passed a bill forbidding any government agency from storing high-level waste in the state, which was actually using their veto against the Yucca Mountain project.[260] DOE sued the State of Nevada for using a veto against a federal mandated project. However, by this time the public trust in the Yucca Mountain project had reached the lowest level in the state of Nevada which became a major hindrance in successfully building and operating a high-level waste facility.

Public participation in the nuclear waste policymaking became significantly important as it dealt with the safety and health of the residents, effective design measures, economic impact on the region, and environmental consequences in case of a disaster. The opposition to the construction of a high-level RNW repository at Yucca Mountain became more poignant after the U.S. Congress introduced a legislation that would have expediated the construction process, also it would have made Yucca Mountain project an interim storage site, even if the secretary of energy later determined that it should not be a permanent repository. Nevada officials saw this legislation as an attempt to force the State of Nevada to accept the repository. Two Senators from Nevada filibustered the defense appropriations bill, holding it up for several weeks. As a result, the proposal did not become a bill and it generated a nuclear waste controversy.[261] In 1985, the EPA set regulatory standards applying to any high-level waste repository. They set a standard that required deaths from radioactivity should not increase more than 1,000 deaths over the next ten thousand years. These standards were challenged in the courts, and they were overturned, however, seven passed by without any measurable progress. U.S. Congress had mandated Yucca Mountain as the place for a high-level RNW repository. In 1989, the Nevada state legislature unequivocally stated its opposition to a repository by passing legislation which declared it "unlawful for any person or governmental entity to store high-level radioactive waste in Nevada."[262] Furthermore, in 1995, the Academy of

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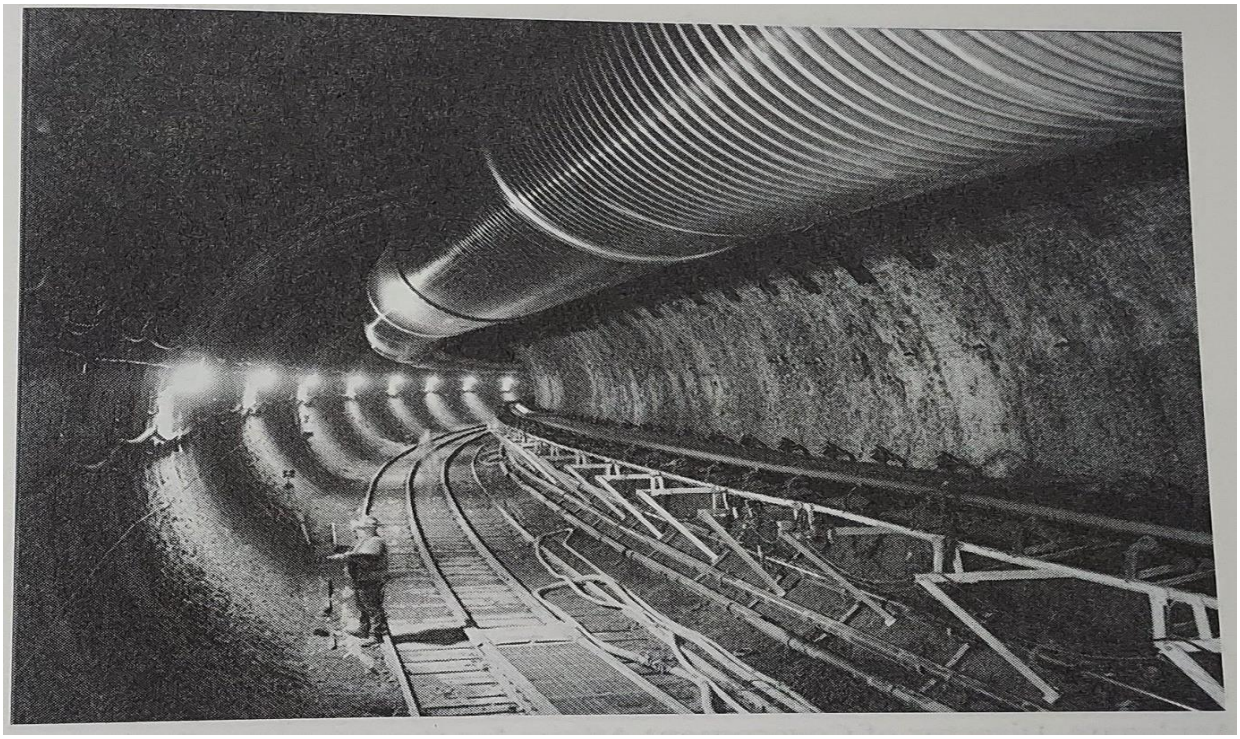
[259] Gerald Jacob, *Site Unseen*, 144.
[260] Robert J. Duffy, *Nuclear Politics in America*, 187.
[261] Ibid., 217.
[262] Gerald Jacob, *Site Unseen*, 170-171.

Sciences committee concluded that a standard for Yucca Mountain should be based on an extension of current conditions and highly speculative future scenarios should be avoided.[263] However, most of the residents and politicians of Nevada were not very happy with the Academy of Sciences committee's recommendations. The evidence suggests that the Yucca Mountain site was not the outcome of a systematic site selection process. Rather, it was a product of political-economic expediency perpetuated by the federal government in order to create a high-level RNW repository on the West coast. In June 2008, DOE submitted an application for a license to establish a high-level repository at Yucca Mountain, however, in March 2010, DOE withdrew their application. By September 2010, DOE announced that it was dismantling the Yucca mountain program. This was not the first time that federal government was withdrawing from a nuclear waste repository project, but the withdrawal from Yucca Mountain project will not be forgotten in near future because it was fraught with technical, logistical, economic, and political issues from the day one. Now, it will be even harder to convince the public of the value of any technology that generates by-products that are extremely hazardous, while their storage and disposal practices are controversial.



[263] William M. Alley, *Too Hot to Touch*, 255.

Figure 3.6 - Exploratory Study Facility at Yucca Mountain, Nevada.

In conclusion, the AEC presented commercial nuclear energy as the cheapest and most abundant source of energy that would raise the standard of living around the world. The U.S. government gladly presented the benefits of the nuclear energy to their fellow Americans and friends abroad, however, the question of what to do with the nuclear waste from the nuclear weapons program and the commercial nuclear power plants was rarely discussed or answered. By the late 1960s, there were over 129 sites in 39 states where high-level radioactive waste from the nuclear energy power plants and weapons production facilities were stored and disposed of. Earlier, the AEC officials were not bothered about the RNW storage and disposal issues, however, later, as many nuclear power plants became operational, they started generating large volumes of high-level radioactive wastes which became a major source of concern for them. All forms of RNW are hazardous and dangerous which require a comprehensive and verifiable storage, packaging, and disposal mechanism that is economically and administratively viable, and which is reliable for hundreds of years, preferably thousands of years. Most of the RNW at the INL are either high-level or transuranic wastes which are found mostly in liquid form but there are also some wastes that are in solidified or gaseous forms. The classification of these waste has been in dispute for some time and is the subject of litigation. The State of Idaho considers this waste to be high-level waste, while DOE considers the waste to be mixed transuranic waste. Another major concern at the INL is transuranic waste that has been disposed of in near-surface pits and trenches prior to the practice of retrievable storage for disposal at a permanent federal facility, the WIPP. Idaho residents were not only concerned about the INL being situated on top of the Snake River aquifer but also that the INL administration was using deep disposal wells to inject liquid radioactive wastes directly into the aquifer. All States in the Union have dealt with the nuclear waste issue differently because some generate large volumes of low-level RNW, so their wastes need more storage and disposal area, while others might produce high-grade RNW but the volume as not as high. The AEC failed in 1971 to establish a geological repository for high-level RNW at Lyons, Kansas. The NAS had reviewed AEC's radioactive-waste disposal practices for years and the NAS had roundly condemned not only the Idaho operation but the AEC nuclear dumps everywhere they existed. Reprocessing of nuclear spent fuel was controversial, expensive, and created more waste. India detonated its first nuclear weapon in 1974 from reprocessing RNW from nuclear reactor that Canada had provided them to use only for peaceful purposes. The INL complex reprocessed spent fuel and made it into solidified forms, which made it easier to store, transport, and manage it, however, it did not reduce the radioactivity emitting nature.

In 1987, the Nuclear Waste Policy Amendment ACT directed the DOE to evaluate only the Yucca Mountain site as the first selected repository for high-level RNW. Finally, in 2009, the aforementioned ad-hoc and schedule-driven changes made by various U.S. administrations regarding the spent fuels/plutonium reprocessing came to a complete halt, when President Barack Obama defunded the commercialization of the nuclear reprocessing. The Low-Level Radioactive Waste Policy Act of 1980 mandated compact

agreements negotiated by states in all regions, and a local low-level RNW burial ground is agreed upon, however, due to various political, economic, logistical, and environmental differences the compacts never became a permanent solution. Some states collaborated with others while some tried to have their own nuclear waste policies. All the utilities were reluctant to provide a long-term storage of low-level RNW, although they knew that there was no high-level RNW repository available in the country which made their nuclear power plant storage a defacto repository for fuel rods/assemblies. In 1975, U.S. government announced an agreement with the State of New Mexico to build a $1 billion facility named Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, where they would deposit military transuranic waste. The establishment of the WIPP project was good news for the INL, where over 100,000 fifty-five-gallon barrels are stored containing military transuranic waste that are waiting for permanent disposal. Later, the U.S. government desired to have high-level RNW placed at the WIPP facility as an experiment. Later, they also wanted to deposit used fuel rods from the nuclear reactors. The WIPP project could only accommodate transuranic RNW from defense facilities, while the U.S. government was still trying to establish a geologic repository for the high-level RNW from nuclear energy power plants. A desirable site will have a low local population density, sufficient available surface water (or, in some cases, the absence of it) and sub-surface formations that provide security in case of accident. In 1985, the DOE presented a smaller list of three sites in the states of Texas, Washington, and Nevada to President Ronald Reagan. However, the search for a repository by the U.S. government had ended in the east, but a search for a geologic repository in the west continued, while ideas that were previously discarded were also entertained. U.S. government announced that the Yucca Mountain, Nevada was considered the most appropriate location for a high-level RNW repository. Nevada officials immediately opposed the development of the Yucca Mountain site, furthermore, they took several legal, political, and public-relations measures to block DOE actions. By 2001, DOE had spent about 4.5 billion to build tunnels and drill bore holes at a thousand feet under the surface at Yucca Mountain. the Nevadans were concerned about the economy of their state that relied heavily on the gaming/entertainment industries, which would be adversely affected if there was an RNW accident at the Yucca Mountain repository. Later, in 1989, the Nevada legislators passed a bill forbidding any government agency from storing high-level waste in the state, which was actually using their veto against the Yucca Mountain project. The Yucca Mountain project was not the outcome of a systematic site selection process. Rather, it was a product of political-economic expediency perpetuated by the federal government in order to create a high-level RNW repository in the West coast. In June 2008, DOE submitted an application for a license to establish a high-level repository at Yucca Mountain, however, in March 2010, DOE withdrew their application. This was not the first time that federal government was withdrawing from a nuclear waste repository project, but the withdrawal from Yucca Mountain project will not be forgotten in near future because it was fraught with technical, logistical, economic, and political issues from the day one. The high-level RNW stored or disposed of at the INL would have to wait a little bit longer for the establishment of a permanent geologic repository.

## Key points:

. The AEC presented commercial nuclear energy as too cheap to meter. However, they did not
talk about how to deal with the backend issue of waste because it was an unimportant issue.
. Low-level, high-level, transuranic, and decommissioned RNW have levels of radioactivity.
. Most of the RNW at the INL are either high-level or transuranic wastes, which are mostly in
liquid form, but also there are solid, and gaseous wastes.
. Since there is no permanent repository, nuclear energy providers expanded their capacity, and
many states put limitations on construction or expansion of nuclear power plants.
. In 1978, Southwest Nuclear Company filed application for a low-level nuclear waste repository
at Carey mine, Lyons, Kansas. However, the state of Kansas never approved the application.
. Robert Erkins warned Idaho officials that RNW from CO would be coming to the INL.
. The AEC claimed that their RNW policies were safe, but the NAS issued an unfavorable report.
. Media reports detailed the hazardous nature of the RNW to environment, water, and humans.
. By early 1970's a deep geologic repository for high-level RNW was still a theory, and the state
of Idaho was still waiting for the U.S. government to the remove RNW from the INL.
. The spent nuclear fuel was reprocessed at the INL from 1953 – 1992, later, the commercial
reprocessing was banned by the U.S. government in 1978 due to fears of proliferation.
. Probably, India and Israel reprocessed the spent nuclear fuel for their atomic weapons program.
. In 1981, ban on the commercial reprocessing was lifted, later, in 2009, it was banned for good.
. The Three Mile Island nuclear reactor meltdown debris was brought to the INL by railcars, and
new orders for nuclear reactors from national and international sources slowed down.
. In 1982, the NWPA provided a framework for the disposal of the spent fuel assemblies and
high-level RNW, while DOE was responsible to design, construct, and operate repository.
. In 1987, only Yucca Mountain site was recommended to be the repository for high-level RNW.

. After successful tests, Yucca Mountain was recommended to be the Study Experiment Site.

. The Low-Level Radioactive Waste Policy Act of 1980 brought compact agreements by states.

. In 1975, U.S. government announced to build a geologic repository in New Mexico (WIPP)
where they would deposit military transuranic waste, which are temporarily stored at the INL.

. The DOE gave up on a site selection for a repository in the east and west coast was an option.

. In 2002, Yucca Mountain project was given light to start construction for a geologic repository,
later, where the high-level RNW temporarily stored at the INL would be transferred.

. The people of Nevada prevailed, and the Yucca Mountain project was suspended in 2010.

. The high-level RNW temporarily stored at the INL will have to wait for a permanent repository.

# Chapter 4

## Blue-Ribbon Commission and Nuclear Wastes in Idaho

As the Carey mine geologic repository project was cancelled by the state of Kansas, the AEC wanted to find a 'temporary storage' location for the commercial radioactive waste. High-level Radioactive wastes are the most dangerous due to their radioactivity emitting nature for a very long duration, and they are primarily produced from the nuclear weapons program, spent fuel reprocessing, and fuel assemblies that are discarded after their life cycle is over at nuclear power plants. The largest producer of high-level RNW are the nuclear power plants in the country. Some sixty years later the problem of storage and disposal of high-level RNW remains, which is nearly 90,000 metric tons of RNW located at approximately eighty different locations across the country, in above-ground containment vessels and cooling ponds.[264] The AEC announced consolidation of RNW quantities by introducing three locations (The Savannah River, the INL, and Hanford Reservation) for massive RNW storage and disposal sites. On September 25th, 1974, after hearing AEC's announcement, Idaho Governor Cecil D. Andrus appointed a Blue-Ribbon Commission that would be responsible to look into the environmental impact of the expansion of the INL high-level and transuranic RNW storage and disposal capacity and how the commercial wastes are going to be handled there. The most important question for the state of Idaho residents and political leaders', what was best for the state of Idaho?

Obviously, in the public perception there were short-term and long-term dangers from the RNW at the INL to the Snake River Aquifer, while there were economic and technological benefits for the Idaho residents. One of the Blue-Ribbon members, Stan Slansky, stated that once the high-level and transuranic wastes were at the INL, they would be difficult to move. Furthermore, Slansky stated that "Once you mess up the environment, the cost accrues to future generations."[265] In addition, he observed that there is a little bit of plutonium in the transuranic wastes, although they are considered less dangerous than the high-level RNW, but they are radioactive for a very long time which requires safety mechanisms and constant monitoring programs. The Commission considered various problems and issues that the state of Idaho would face if the INL was selected as the 'temporary' location for storing and disposal of transuranic and high-level

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[264] See Nuclear Waste Disposal, U.S. GOV'T ACCOUNTABILITY OFF., https://www.gao.gov/nuclearwaste-disposal [https://perma.cc/VGL8-GG5E]; see also LANCE N. LARSON, CONG. RSCH. SERV., IF 11201, NUCLEAR WASTE STORAGE SITES IN THE UNITED STATES 1 (2020), https://sgp.fas.org/crs/nuke/IF11201.pdf [https://perma.cc/7KP3-GN52].

[265] Meeting of the Governor's Blue Ribbon Study Commission on Atomic Wastes, Monday, October 7th, 1974, Idaho State University, Administrative Conference Room, Pocatello, Idaho, accessed ISU Archives 08/24/2022. Pg 02.

RNW. Davis questioned the motive of storing high-level RNW in such a close proximity to Snake River Aquifer and local acceptance of the depository would be a major consideration.[266] First, the Commission understood that a steady stream of RNW in large quantities would come to the West, while transportation of the RNW would be handled by the federal government, however, the attitude of the Idaho residents towards the expansion of the RNW capacity and storing at the INL in large volumes was not positive. In addition, the Commission considered the economic impact of extra RNW at the INL and also the waste packaging costs from 1975 through 1980:

| | | |
|---|---|---|
| Transuranic only: | $15,200,000 | |
| Operation & RCE: | $ 3,200,000 | |
| (federal funding) | | |
| Total: | | $18,400,000 |
| Processing Low-Level: | $13,000,000 | |
| Operation & RCE: | $ 9,400,000 | |
| Total: | | $22,400,000 |
| Storage cost alone: | | $13,200,000 |
| Total through 1980: | | $54,000,000 |

Plus, the cost from 1980 through 2000 would be $550,000,000.
In addition, the total cost for the high-level RNW through the year 2000 would be $1.5 billion; for transuranic waste, cost would be $1 billion; and a total cost of $2.5 billion.[267]

It is clear by the aforementioned estimates that the extra volume of RNW would bring substantial amounts of revenue to the INL, and the surrounding communities would benefit from the economic stimulus presented to them in various manners. Second, the Commission members understood that alpha materials (high-level RNW) that are being considered for storage and disposal at the INL in large quantities would be radioactive for thousands of years. Bud Davis, Commission Chairman asked in this regard that "if we were selected as the site, what is this going to do to us, and the other question, if we were selected as the site, what would this do for us?"[268] Primarily, Davis asked Dr. Frank Pittman, Director of Division of Waste Management and Transportation about the impact of the large volumes of the proposed high-level and transuranic wastes on the environment, water, and all living beings in the state of Idaho. Furthermore, Davis asked: "Are the site [The INL] capabilities about the same for the high-level wastes as they are for the transuranic wastes? Are they similar, are they the same, or would one be preferable over the other?"[269] Pittman answered by stating that the capabilities of the environment of the three sites to handle the two different varieties of RNWs depends on the proper choice of coolant that would make the environment accept both RNWs.[270] Pittman meant the substance circulated in the nuclear power plants and reprocessing

[266] Ibid., 04.
[267] Ibid., 03.
[268] Ibid., 11.
[269] Ibid., 14.
[270] Ibid.

facilities to remove or transfer heat. Davis asked Oscar Field, Commission member, if there were any concerns from the Farm Bureau or farmers in this respect. Field replied that, "The whole industry is very concerned about this problem of pollution, and the environment people are concerned about our pollution of the waters, too, such as the salt that washes off the land. The threat of nuclear pollution is a real one to our people, it looks like the decisions along the line will have to be as safe as we can be with this thing."[271] From this interaction between the members of the Commission, it could be easily deduced that Field is trying to make sure that there is no chance of RNW contamination from the INL of the Snake River Aquifer, which is the largest source of fresh water for the farming and residential communities in Idaho.

Third, the Commission members understood that the waste storage and disposal technology had not been created and perfected in order to satisfy the concerns of the Idaho residents. In this regard, Mike Christy stated that "If a much greater percentage of the money that had gone into waste research had been afforded that effort 10-15-20 years ago. If waste had gotten its fair share, isn't it true that this technology would have been on the line by now and we wouldn't have to be faced with this?"[272] Christy deduced that the lack of technology and resources admission by the AEC strengthens public perception of lack of interest in the RNW storage and disposal programs. Earlier, we discussed that the AEC officials had accepted that the storage and disposal of RNW was not considered a major issue, and it was assumed that over time the technology would be able to take care of the waste problem. Pittman replied in this regard to Field by stating that "If waste had gotten the type of money put into development that our office is going to have, and we had the time, starting back in 1943, we wouldn't be sitting here with 150 tanks at Hanford and 80-odd at Savannah River .... The technology would have been resolved today."[273] Specifically, Pittman's statement is conveying to the audience that the U.S. government's nuclear waste management program is playing catch-up with the technology due to various problems, such as Cold War pressures, nuclear safety measures for the Allied Nations, nuclear weaponization programs, and commercial nuclear energy production, which are all front-end production projects. The aforementioned questions provide some answers to solve the RNW storage and disposal issues at the INL, but the nuclear waste program has many dimensions that need to be discussed. Chuck Rice, Commission member asked "[w]here does this fit into a total program? It sounds to me as if—or it doesn't appear to me, anyway—that Commission has done a total program on waste management."[274] Every Commission member understood the importance and significance of Rice's question because it placed the comprehensiveness of the waste program due to lack of resources, technology, transportation, political will, and safety of the environment. Pittman replied to Rice that "As I mentioned earlier, this is just a statement on how to get started. What are you doing with all the high-level wastes that are now being generated?"[275] Pittman expressed that high-level wastes issue needs to be

[271] Ibid., 16.
[272] Ibid., 16.
[273] Ibid., 20.
[274] Ibid., 21.
[275] Ibid., 22.

resolved immediately by authorizing the INL as a site to start accepting the high-level RNW either to be buried in trenches or the burial ground. Furthermore, he stressed there are transuranic wastes that contain plutonium and other hazardous elements, which require a long-term vigilance regiment because of their radioactivity emitting nature for a long time.

Fourth, the AEC had promised Idaho officials that the RNW at the INL would be stored there on temporary basis, and once a deep geologic repository was available, they would be retrieved and removed outside of the state of Idaho. In this regard, Davis asked: "That is, how long is 'temporary'? Until we see how these temporary solutions fit into a long-range plan."[276] The AEC has been storing or disposing of RNW on 'temporary' basis for decades in many locations in the country, and they have promised various Idaho politicians to remove the RNW from the INL once a deep geologic repository is available. In this regard, Pittman replied that "Our target is in the range of 30 years to be in a position to put this stuff away. If we didn't have enough technology already developed and proven within the laboratory and field experiments to say that bedded salt can accept this material, I'd feel a little queasy about this whole thing."[277] However, Pittman was unsure about the public perception about the safety and manageability of the RNW at the INL or around the country in the near future, while the long-term public confidence depended upon the successful implementation of comprehensive nuclear waste storage and disposal policies/programs. The public perception of safety and manageability of the RNW plays a major role in the implementation of storage and disposal policies across the country. The AEC suffered from a trust deficit due to various RNW mishaps, lack of accountability or access, political manipulation, west-coast site selection, and having varying standards for commercial and defense wastes. Al Wilson asked Wayne Bills, a Commission member in this regard that "Can you trust the AEC? Have you any assurance that once you accept the waste storage facility and store all of the waste you will really get the millions of dollars for the development programs?"[278] Bills replied: "There is only $600,000 that goes into operations and the rest of it is going into development, and it's increasing all the time, so I think that while we've heard some arguments, you know, that give us the development and we'll store your waste, in some ways we're getting development."[279] It is clear from Bills answer that there was not a significant amount of funds that would be transferred to the state of Idaho. In addition, he pointed out that the INL will be getting our proportionate share, this is a service to the nation and the INL will be getting the waste technology with the proposed waste storage. Pittman made a comment in order to make sure that the audience understand what technology is at hand and how RNW could be handled at the INL in the future. He said that "It will require a fairly good technology to take all this waste to see what to do, how to do it, and then go ahead and do it—to make it safe not only for 20-year storage of the type you're doing out there now, but the longer-term surface storage."[280] At this point,

[276] Ibid., 24.
[277] Ibid., 25.
[278] Ibid., 27.
[279] Ibid., 27.
[280] Ibid., 28.

Pittman seems to be optimistic about the availability of new waste technology at the INL that would make it easier, safer, and economical for high-level RNW storage and disposal. He further explained that in comparison, the transuranic waste does not have the problem of heat and radiation, but they have a problem of being in large quantities, which requires a conversion into smaller volumes for storage.

Fifth, many Commission members agreed that the state of Idaho had contributed greatly to the development of nuclear technology and now they were further enhancing the nuclear program by considering expanding the INL capabilities to store and dispose of high-level and transuranic RNW. In this regard, Pittman was asked by Davis, why it is in the best interest of Idaho to be designated as the "best site" for high-level and transuranic wastes? Pittman replied that "the INL already has off-sites wastes, and having alpha wastes would add to the program of development of waste treatment. The government's $100 million glass-making plant technology was designed here in Idaho, and we have significantly contributed to this program."[281] Furthermore, he added that the work at the INL would cost about $3.5 million on research and development, and this process will grow because there are many types of technical personnel available here, and there are facilities for research and technical projects that would improve management methods.[282] Although Pittman answered all the questions positively for the placement of the high-level and transuranic RNW at the INL as the temporary storage and disposal site, but he ignored the main question of the removal of the RNW from the INL for permanent storage and disposal at a geologic repository outside of the state of Idaho. All the methods of interim storage of RNW were considered safe by the AEC, and yet they only recommended three western states for high-level and transuranic wastes, and there were no recommendations for an east coast site. In this regard, Chuck Rice said that it does not appear that this was an environmental statement, arriving at a conclusion as to the location of the site if the government wanted to have all three in the West. Pittman replied that "When it comes right down to it, it is public acceptance, not technical factors, that determines site locations."[283] This statement by Pittman establishes a level of arbitrariness in the process of picking a site in the west by the U.S. government because there was no state in the east coast that was willing to accept high-level RNW site within their territories. He further elaborated that a site in the City of Detroit was under consideration for the storage of high-level RNW, but he believed that if there was considerable public objection against the site, then the U.S. government decides against that location. So, if the aforementioned statement portrays the AEC's site selection policies, then why wasn't this level of regard provided to the residents of Idaho or the residents of the western states?

The Commission members were also concerned about the nuclear industry experts who were not on board with the idea of having a high-level RNW storage and disposal site at the INL. Davis asked that "Now, are there any technical people in the field who are going to come out and say that this is a danger and that the techniques are not perfected to

[281] Ibid.
[282] Ibid., 06.
[283] Ibid., 08.

the point that …"[284] To this question, Pittman replied that "I can't be sure what some of the technical people in the field are going to come out and speak. We have asked the National Academy of Sciences (NAS) to establish a standing waste management committee. Then everything that comes up that's a part of our program, they establish a working group to view in detail the activities that we have in mind."[285] So, if the NAS was being consulted on 'everything' then why were none of their scholars/experts present at this meeting and why their research about the RNW site selection not taken into consideration? Pittman addressed this issue by stating that "Now, they [NAS] don't get into site selection problems. They get into only the technical aspects of the concepts themselves."[286] In other words, the NAS is being asked for their expertise by the U.S. government only on issues/policies that they are confident there will be no conflicting views or significant opposition by them.

Even within the Commission there was pushback to Pittman's stance on availability of technology in the near future that will take care of the high-level RNW. Rice asked in this regard that "You've got a 20-year program here of which 15 is storing some of this high-level radioactive waste in a salt mine. You're telling us that a retrievable storage is set for a period of 20 to 30, and today I hear 50 to 100 [years], maybe, but some kind of period like that, that is, at this point, dependent upon having available a permanent repository in salt."[287] This question by Rice sets up a very problematic scenario for the AEC because they did not have a finalized site, perfected technology, political will, nor the resources to provide a comprehensive permanent waste program. Pittman replied that "I'm saying that that permanent repository –that technology can be proved within 15 years from the time we start, and I hope we start making a …" Rice cut off Pittman, and asked him, "What is the basis for that confidence on your part? We're still in the process of doing design development, experimental laboratory work, and so forth."[288] Although Pittman was trying to answer the questions posed by the Commission members as clearly as possible, but it was becoming clear that there were many technical, geological, administrative, and environmental complications that were still unresolved and without solving them, the INL would have major RNW storage and disposal problems. Nevertheless, Pittman replied that "In the laboratory experimental work, we've done all that needs to be done; we can't determine anything else on the surface. The next step is to build this pilot plant and to get some measurements from enough canisters to give you some statistics to verify, or not, the laboratory work, and we think that 10-year program is more than adequate to make measurements to verify the laboratory work."[289]

The abovementioned explanation by Pittman is summarized from about two pages of technical jargon. The Commission members understood that most of the high-level

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[284] Ibid., 31.
[285] Ibid., 31.
[286] Ibid.
[287] Ibid., 34-35.
[288] Ibid.
[289] Ibid., 35.

RNW would be transported from the nuclear power plants on the east coast to the INL. So, they wanted to make sure that all logistical, administrative, and environmental issues were addressed upfront; while there were no unforeseen delays, RNW accidents, or chances of contamination of the environment. The Commission members tried to look into numerous issues that were relevant to the safety and manageability of the RNW at the INL. Slansky said in this regard that "I think that's so vital that this waste problem part of the overall nuclear power picture is critical, it is important that we face up to it, it isn't any longer a community problem, it's a national problem. So, I don't think we could underestimate the importance of this on a national basis and this period that we have now."[290] Pittman agreed that there was pressure to release the report, so the public is aware of issues related with the high-level RNW storage and disposal at the INL. In this regard, Davis made an observation that "it is not necessarily so that the high-level waste and the transuranic waste be stored at the same site…there needs to be – at least in the case of Idaho – a much deeper environmental impact study to be conducted in the state before a final determination is made."[291] In addition, he said that "We have to weigh technological advances, the guarantees of safety, the relationship to the aquifer, the relationship to the environment of Idaho; we have to weigh the public's acceptance or potential acceptance of storing high-level waste or transuranic waste in Idaho and take it from there. There will be a lot of public response. 'Can the people of Idaho buy the concept?'"[292] It is a valid question, why are the Idaho residents hesitant to agree to have more high-level RNW brought in from out of state sources in large volumes to the INL? Would these proposed larger volumes of high-level RNW put the Snake River Aquifer's safety and productivity under a constant threat of RNW contamination?

The safety of the Snake River Aquifer and environment is paramount to the residents of Idaho and the Commission members understood the gravity of their point and tried to address them to the best of their abilities. In this regard, Slansky stated that "When you look at the total situation, you begin to see problems in the overall areas of safety, of transportation, of storage, of sabotage, of security, and the like. So, I would say, be very careful of jumping to any conclusions that a certain decision on the AEC's part was made without due consideration that they missed a point. Actually, they have so many things to worry about that it's rather disconcerting to pick all the loose ends up."[293] It is clear from Slansky's statement that there were many elements of the nuclear waste program that were not perfect, and others needed more resources or technological boost. One of the main items that the Commission did not agree upon was the transportation of commercial spent fuel from the east coast, which was one of the AEC's stipulations for the new storage site. Brailsford states in this regard at the Hailey City Council meeting that "In 1974, the Governor's Blue-Ribbon Commission declined to support commercial fuel into the state. In the early 1990's, there was a lot of public support for keeping commercial fuel out, and the result was the 1995 agreement. Idaho has an INL oversight

[290] Ibid., 37.
[291] Ibid., 38.
[292] Ibid., 39.
[293] Ibid., 39.

program. The state still has its responsibility in oversight."[294] However, the position of in charge of the oversight of the 1995 Agreement was eliminated due to political pressure. Yet, the most important aspect for the Commission members was to finalize an explanation for the residents of Idaho; what was being recommended, why was it being recommended, what are the impacts on their economy, environment, and the Snake River Aquifer.

## The Blue-Ribbon Commission Report & Recommendations

The initial meeting took place on September 12th, 1974, at the Idaho State university, the Blue-Ribbon Commission decided to hold public hearings to receive input from the residents of Idaho regarding the AEC proposal of storing and disposing high-level RNW at the INL. They held six public hearings to incorporate any statements from Idaho residents in their report. After the hearings, the Blue-Ribbon Commission met again on November 7th, 1974, all the feedback and statements they had received were reviewed, the final report was unanimously approved, and it was forwarded to Governor Andrus on November 12th, 1974, at Germantown, Maryland.[295]

The Commission said in their summary that we cannot endorse the expansion of activities at the INEL [INL] to include the storage of commercial wastes because there is inadequate information in the Draft Environmental Statement, WASH-1539 provided by the AEC.[296] The Blue-Ribbon Commission Report is extensive, and it deals with numerous nuclear waste issues and other administrative problems that are not relevant to this research paper. Here, I am going to summarize pertinent elements from the report and present all recommendations that are specifically connected with the expansion of the INL's capacity to store more high-level RNW. Commercial nuclear energy providers should maintain RNW storage temporarily at their facilities. The U.S. government should increase their efforts to find a geologic repository site, so the high-level and commercial RNW stored at the INL can be transferred outside of Idaho. The state of Idaho wants a firm date as to when the RNW at the INL can be transferred outside of Idaho. The state of Idaho would like to see environmental and economic data before making a decision about expanding the INL RNW storage and disposal capacities. The Commission feels that there should be public hearings in the state of Idaho and Washington, D.C. about this project. There should be independent environmental monitoring of the INL activities by

[294] The Hailey City Council Minutes. Beatrice Brailsford Presentation (A Member of Snake River Alliance), June 15, 2015. Accessed on June 17th, 2021.
[295] Governor's Blue-Ribbon Committee on Atomic Wastes Report, Idaho State University, Office of the President, published on November 6, 1974, 03. Accessed on 08/24/2022. Public hearings were held as follows:
October 29: Lewiston, Moscow, and Idaho Falls.
October 31: Boise.
November 4: Idaho Falls.
November 6: Pocatello.
[296] Ibid., 01.

the state of Idaho. There are ten nuclear waste management recommendations in the Blue-Ribbon Report:

1- Since INEL [INL] has developed the technology necessary to insure safe interim storage at the waste-generating site, the industries themselves should be responsible for interim storage. This would free AEC to concentrate on the development of the permanent disposal facility.
2- The "high-level" wastes presently have more transuranium content than most transuranium waste. It needs to be clarified prior to arriving at decisions regarding interim storage or ultimate disposal.
3- Accelerated efforts in the development of a viable geologic disposal facility should be pursued.
4- The fuel cladding hulls should be handled separately from the high-level wastes and the more usual transuranium wastes. Consideration must be given to processing the hulls to recover both the transuranium elements and the zirconium.
5- The transuranium wastes should be prepared for the geologic disposal facility while at the commercial waste generating sites. The transuranium wastes should be converted to a compact, non-combustible form which would be suitable for placement in a geologic disposal facility.
6- All retrievably stored waste should be removed to a geologic disposal facility on a specified timetable with consequent phase-out of no longer required interim storage facilities.
7- The AEC should provide a firm commitment as to the schedule for retrieving and converting to satisfactory form for ultimate disposal of the radioactive wastes previously buried at the INEL [INL].
8- The AEC should consider the proposals which have been made for independent environmental monitoring by local governmental agencies. Funding should be provided from revenues derived from the production of radioactive wastes.
9- An accelerated program for partitioning high-level waste to produce a transuranium-free waste should be implemented to assure that the usable plutonium is not irretrievably stored and to reduce the time that the high-level waste must be isolated.
10- The overall waste management program should be accelerated to include the requirement that all shipments from commercial sites be in an environmentally non-reactive form (e.g., glass, cement, ceramic, or other acceptable forms for high-level and non-combustible for transuranium waste).[297]

In addition, it was recommended that the transuranium contaminated wastes from the military program be placed in what the Committee believed to be safe interim storage in a manner proposed for the future. Presently, transuranium-contaminated waste, the technique is to stack drums and fiberglass covered boxes of the waste on asphalt paved pads and cover with plywood, plastic sheet, and dirt. Some 775,000 $ft^3$ of waste are stored safely in 20-year-life containers and readily retrievable for shipment to a treatment plant

[297] Ibid., 5-6.

or to a geologic disposal facility. However, a separate quantity of transuranium-contaminated waste is located in covered trenches at the INEL [INL] in a less retrievable form. The condition of this waste has been examined by exploratory digging and a plan proposed for exhuming, sorting, incinerating combustibles, and repackaging in 20-year-life containers in anticipation of shipping the materials to a disposal facility.[298]

The high-level RNW generated at the INL's ICCP have been solidified by fluidized-bed calcination for 10 years; 2,600,000 gallons of liquid waste have been converted to 42,500 $ft^3$ of granular solid which is stored safely near the surface in stainless steel bins, doubly contained in concrete vaults. Current plans are to demonstrate the retrieval, treatment, packaging, and on-site storage of stored calcine. In the future, the ICCP should proceed with the development and addition of plant capabilities to reduce the transuranium element content of high-level waste to a level at which the environmentally limiting elements be strontium-90 and cesium-137. Such waste would change the potential disposal techniques which might be applicable to a transuranium-free waste. The time of storage could thus be reduced from a million years to approximately a thousand years.[299] Furthermore, the Commission is strongly in favor of developing our nuclear energy resources to meet current and projected national energy needs. The Commission also recommended a plan to build a meaningfully sized facility to demonstrate the retrieval, processing, and packaging of transuranium-contaminated waste which was buried in trenches years ago. This unit could be put on a 24/7 shift process that would process all of the wastes and place it on Idaho transuranic storage area pads at the INL.[300] It is important to note that Blue-Ribbon Commission urged the AEC to take specific actions prior to reaching any conclusions about selecting the INL for a retrievable storage of commercial RNW. They also stated that the AEC should expedite their efforts to achieve a geological repository, so the RNW at the INL could be removed and placed permanently at that location outside of Idaho.[301] In addition, The Commission opined that the role of nuclear waste generating entities should include storage of RNW at the locations where generated. Governor Andrus presented these recommendations in December 1974 to the U.S. government in Salt Lake City. He stressed two points: 1) Any radioactive storage not to be above the aquifer and be placed in the northwestern area of the INEL [INL] or even in other places in Idaho; and 2) that all the existing buried radioactive waste be removed by the end of the century.[302] Andrus is consistent in his message to the AEC that there should be a concrete plan to remove RNW from the INL outside of the state of Idaho.

The Commission sought the continuation of important research and interim storage programs at INEL [INL], as it would be in the best interests of the national energy policy. The Commission also wishes to maintain the high quality of the environment in

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[298] Ibid., 7.
[299] Ibid., 8-9.
[300] Report of The Governor's Blue Ribbon Study Committee on Atomic Wastes, Radioactive Waste Management Recommendations, Future, November 6, 1974, 8. Accessed on 05/27/2022.
[301] Ibid., 1.
[302] *Twin Falls (ID) The Idaho Register*, Atom burial Backed by Andrus, Church, 12/12/1974.

Idaho for all times. These two considerations have guided the committee's recommendations and should guide future assessment of public or private power programs.[303] In addition, the Commission realized that the INL has been internationally recognized in the field of nuclear waste management for many years. Commercial RNW storage technology has been developed at the INL and their techniques and procedures will be used by the nuclear waste storage industry. The transuranic waste could be stored near the AEC generated wastes which could develop and enhance common facilities for further development that can fully utilize the INL expertise and research capabilities. The Commission recognized the importance of the nuclear energy research and waste management program at the INL because both programs are interconnected with state and national security needs, and efficient energy production is a catalyst for a robust economy.

## Radioactive Waste Task Force 1979

The Blue-Ribbon Commission gave their findings and recommendations to Governor Andrus in October 1974, who, later in December presented them to the federal government for implementation in Salt Lake City. In addition, there were reports circulating about low-level RNW leakage into the Snake River Aquifer from the INL's waste management program that needed to be fixed. Idaho residents and politicians waited many years for the federal government to find a permanent solution for the storage and disposal of the RNW at the INL. Later, in November 1979, John V. Evans, Idaho Governor announced the formation of a Task Force that would review the inefficiencies in the INL's waste management program, and it will provide solutions to the state of Idaho. Specifically, the problem was with several injection wells and seepage ponds in use at the INL for the purpose of disposing of a portion of the water contaminated with chemicals and radioactive isotopes. The bulk (86 percent) of the radioactivity generated at the site is stored as liquid or solid waste in retrievable containers. Of the remainder, 1.6 percent is disposed to the atmosphere and 0.02 percent as liquid to the ground. Approximately 20 percent of the latter is through an injection well at the Chemical Processing Plant. Most of this radioactivity is associated with a waste stream that constitutes about 1 percent of the water going down the well.[304] It is understood that the wells being used by the employees produce water with radioactive contamination which would produce approximately four millirems per year (mrem/year) exposure, assuming a "normal" intake of water. Four mrem/year is the equivalent of the Environmental Protection Agency and State of Idaho standard for community water supplies. The Task Force estimated that the continued use of disposal wells that discharge directly into the aquifer does create the possibility of an accidental discharge of high-level or concentrated

[303] Governor's Blue-Ribbon Commission on Atomic Wastes, Special report, Statement of Policy, Documents Div Idaho State University Library, Pocatello, Idaho. Published 1974. 140008521, accessed on 08/24/2022.
[304] Radioactive Waste Task Force, Report to the Governor, State of Idaho-John V. Evans, Governor, Published December 13, 1979, accessed 08/24/2022, pg.2.

radioactive materials into the aquifer; therefore, all injection wells should be protected from any accidental discharges.[305]

Figure 4.1 - Courtesy of Rexburg Historical Society, photo of Teton Dam by Mrs. Eunice Olson, 5 June 1976.

The Chemical Processing Plant at the INL has state of the art instrumentation, which confirmed the disposal of low-level radioactive wastes directly into the Snake River Aquifer through their injection wells. The Task force understood that the discharges to the aquifer have concentrations less than the state and federal Radiation Concentration Guide values for discharges to areas where public access is unrestricted. While meeting

[305] Ibid., 2-3.

these standards, the waste concentrations routinely exceed drinking water guidelines established by the Environmental Protection Agency and the State of Idaho.[306] The Task Force examined the feasibility of achieving zero discharge of RNW and toxic chemical materials. Although it is impossible to reach zero concentrations once these materials have been created. The Task Force focused on the streams that essentially contain all of the radioactive materials, recognizing that extremely low, generally undetectable materials may be found occasionally in other waste streams. However, the continued use of disposal wells that discharge directly into the aquifer does create the possibility of an accidental discharge of high-level or concentrated radioactive materials into the aquifer.[307] Although the Task Force found no immediate health hazard to the citizens of Idaho from the disposal of RNW at the INL because they met federal guidelines for releases to controlled areas. But some of the production wells at the INL would violate state and federal standards for community drinking water systems. Interestingly, there are no established standards for part-time supply wells of this type. However, as more data is furnished about the effects of low-level RNW, new health effects may be discovered that will lead to new, and significantly lower the criteria. The Task Force believed that there were alternatives to the presently used RNW disposal mechanisms/policies at the INL that would reduce the likelihood of Idaho residents being exposed to any radiation resulting from the INL nuclear research or waste management activities. Furthermore, the Task Force believed that these alternatives would also reduce the potential for any inadvertent or intentional discharge of harmful materials into the Snake River Aquifer.[308] The Task Force presented alternatives and recommendations in their report to Governor Evans.

The Task Force asked for immediate attention given to the following alternatives:

Liquid radioactive wastes should be treated by total evaporation through either lined ponds or industrial processes such as RNW disposal to strata the Snake River Aquifer or use of closed systems. If water chemistry is suitable, then RNW disposal to the earth can happen through leaching ponds or surface applications. Phosphate corrosion control must apply to have best results if cycling of cooling water is required. For cooling water wastes, use shallow drain wells or leaching ponds are also suitable.[309] The alternatives were dismissed by the U.S. government for not being economically feasible and land utilization would be prohibitive.

Recommendations to Governor Evans:

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[306] Ibid., 2.
[307] Ibid.
[308] Ibid., 5.
[309] Ibid., 6.

1- The state brings[s] every resource to bear in an effort to have the Department of Energy stop the practice of disposing of low-level radioactive wastes to the Snake River Aquifer.
2- The state insists that the Department of Energy explore disposal alternatives with the goal of immediately eliminating disposal practices which could in any way degrade the quality of the Snake River Plain Aquifer.
3- The state negotiates a timetable and binding agreement with the appropriate federal agencies as rapidly as possible. The directors of the Idaho Departments of Water Resources and Health and Welfare should report monthly to the Governor the status of implementing procedures to prevent further degradation of the Snake River Aquifer.
4- The state insists that all sewage and surface runoff disposal facilities meet state standards. The practice of injecting sanitary wastes into the aquifer should be stopped immediately, and treatment practices implemented that conform to the regulations established by the Idaho Board of Health and Welfare.
5- The state encourages the Department of Energy and the Geological Survey to expand their monitoring programs. An increase in both the frequency of sampling and the number of off-site sampling points would allay many concerns. Routine determination of the concentrations of a greater number of radionuclides as part of the on-going ground water monitoring program is desirable.
6- The state seeks improvements in the Department of Energy administrative practices involved in routine monitoring and safety activities at the INL.
7- The state increase funding and manpower levels for the state's program of auditing and monitoring activities at the INL.
8- The state formalizes and adopts rules and regulations for disposal wells so that the Department of Energy has specific criteria expressing the wishes of the state.
9- The state continues its efforts to gain "primacy" through the Environmental Protection Agency for administration of the Underground Injection Act. "Primacy" would effectively resolve any questions about the legality of the state's position concerning disposal operations at the INL.[310]

In addition, the Task Force only addressed those monitoring activities at the INL which dealt with liquid waste disposal. It was understood that the movement of nuclear wastes through the Snake River Aquifer has been adequately documented. The state-of-the-art instrumentation at the Chemical Processing Plant was integrated with an automatic diversion system which ensured that fluids exceeding radiation release guidelines did not reach the well. This well was the only disposal facility which disposed of radioactive wastes directly into the aquifer. The Task Force found out that the administrative arrangements associated with the system were very complex. It required a lengthy, continuous presence by the Task Force members or state staff to fully understand procedures for reporting or preventing environmental "accidents." The Geological Survey's program of groundwater monitoring at the [INL] site is recognized throughout the scientific community as one of the

[310] Ibid., 7.

outstanding monitoring efforts in the nation.[311] In addition, the Geological Survey developed a model to predict waste movement through the Snake River Plain Aquifer, this model is based on 12 years of data and is an extremely useful tool. Furthermore, the Idaho Department of Water Resources and University of Idaho's Water Resource Research Institute developed a model covering a much broader area. These two models provided satisfactory monitoring of the Snake River Aquifer, while keeping the information updated in various different forms and programs. It was understood that no monitoring can ever be considered totally satisfactory but increasing the size of the well network and making more frequent determination of specific radionuclides would provide more valuable information for the INL administration. The state of Idaho officials and industry experts agreed that an elaborate monitoring program will be required to "track" the movement of the RNW moving through the

[311] Ibid., 4.

Snake River Aquifer.[312] The problem with all RNW at the INL had been the inconsistency in storage and

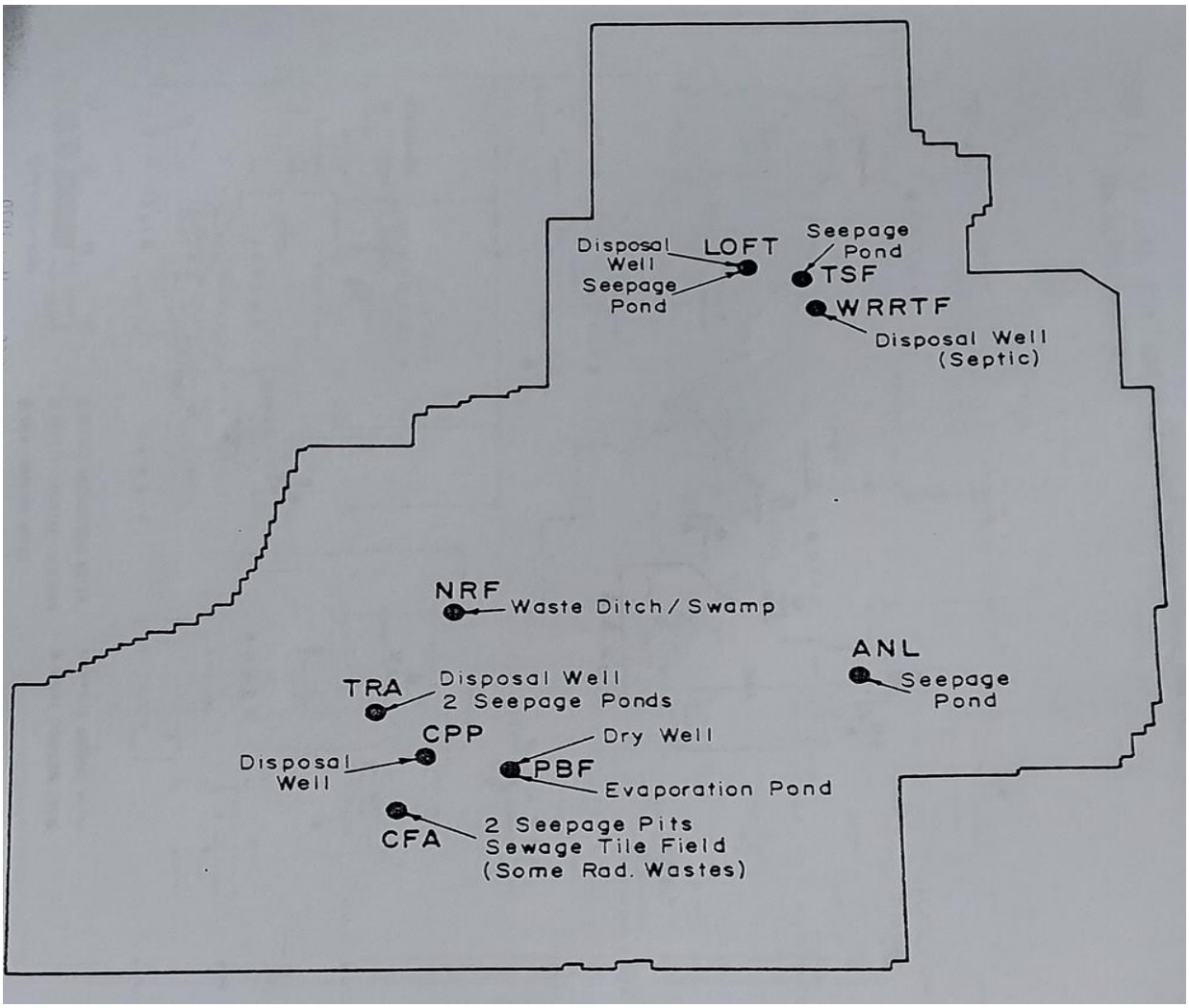


Figure 4.2 – Map of Liquid Disposal Sites at the INL, Courtesy of Department of Energy, 1979.

disposal policies that were implemented by the AEC. Plus, the Idaho politicians and residents sensed that the federal government wanted to skirt their responsibility of moving the RNW from the INL complex to a repository outside of the state of Idaho.

[312] Ibid.

The Task Force reviewed various sources of radiation that could impact homes, humans, and the environment. The following table describes their findings in detail:

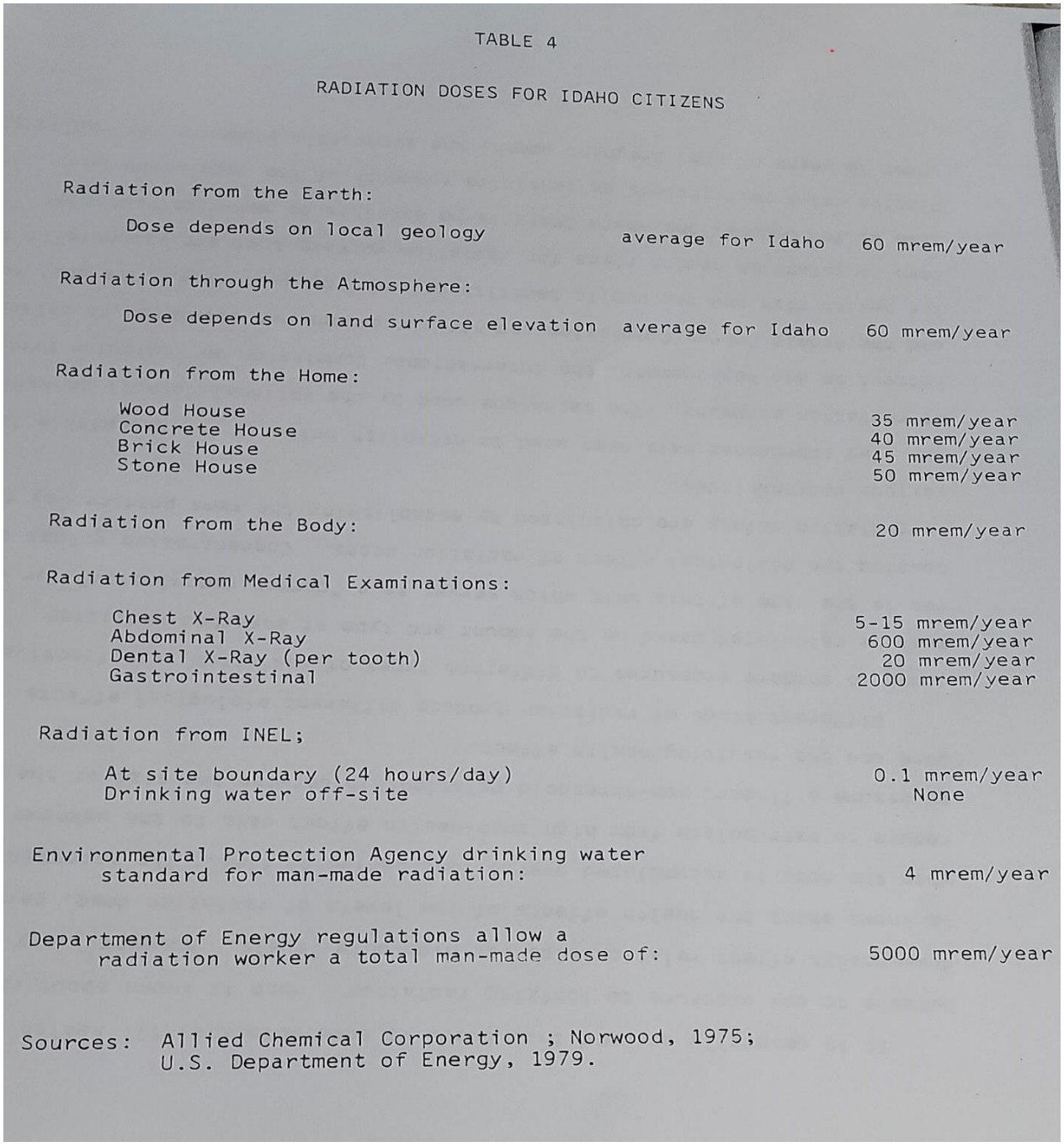

TABLE 4

RADIATION DOSES FOR IDAHO CITIZENS

| | | |
|---|---|---|
| **Radiation from the Earth:** | | |
| Dose depends on local geology | average for Idaho | 60 mrem/year |
| **Radiation through the Atmosphere:** | | |
| Dose depends on land surface elevation | average for Idaho | 60 mrem/year |
| **Radiation from the Home:** | | |
| Wood House | | 35 mrem/year |
| Concrete House | | 40 mrem/year |
| Brick House | | 45 mrem/year |
| Stone House | | 50 mrem/year |
| **Radiation from the Body:** | | 20 mrem/year |
| **Radiation from Medical Examinations:** | | |
| Chest X-Ray | | 5-15 mrem/year |
| Abdominal X-Ray | | 600 mrem/year |
| Dental X-Ray (per tooth) | | 20 mrem/year |
| Gastrointestinal | | 2000 mrem/year |
| **Radiation from INEL;** | | |
| At site boundary (24 hours/day) | | 0.1 mrem/year |
| Drinking water off-site | | None |
| **Environmental Protection Agency drinking water standard for man-made radiation:** | | 4 mrem/year |
| **Department of Energy regulations allow a radiation worker a total man-made dose of:** | | 5000 mrem/year |

Sources: Allied Chemical Corporation ; Norwood, 1975;
U.S. Department of Energy, 1979.

Figure 4.3 – Source: Allied Chemical Corporation; Norwood, 1975; U.S. Dept. of Energy, 1979.

## Economic Impacts of the INL on the State of Idaho

All federal laboratories/facilities in the country create an economic stimulus for the neighboring businesses and cities. The INL generates an economic stimulus which plays a leading role in the development and progress of local economies. After the end of the Second World War, the U.S. government established numerous military and non-military facilities/laboratories across the country, which have stimulated economic growth in local communities. Earlier, we briefly discussed the economic impacts of the INL from its inception in 1949 on the state of Idaho in Chapter 1. However, here specific data and details regarding the INL's economic stimulus and its impacts on the state of Idaho will be discussed. Although the INL's economic stimulus is spread across the state of Idaho in various shapes and forms, the six counties encompassing the INL complex have benefited the most: Bonneville, Bingham, Bannock, Jefferson, Butte, and Madison. Furthermore, the City of Idaho Falls, Idaho has majority of the U.S. government offices, along with the offices of their agencies and private contractors, and a majority of the INL employees live there. The Idaho State University, Pocatello has been the beneficiary of educational grants and internships at the INL.

It is understood that there are direct and indirect effects on the economy whenever there is an expansion in businesses or services in any given area. The direct effect includes the wages and salaries of employees of the business. Indirect effects arise from payment to local suppliers who provide goods and services to the business. The INL is credited with a significant share of state of Idaho's employment, while its employees contribute to governmental tax revenues, local economies, and other industries well above the statewide average. We will review available socio-economic data from the six counties adjacent to the INL from 1985 – 1995, which will help us understand the economic impacts from its economic stimulus. As a percent of all state of Idaho employment, the INL grew from 0.18 % in 1950 to 2.8 % in 1985, which is a significant increase in creation of jobs at the INL complex and other related industries. In 1985, the INEL [INL] employed one out of every eight employed persons in its primary impact area (Bonneville, Bingham, Bannock, Jefferson, Butte, and Madison counties).[313] Furthermore, for the past 37 years the economy of southeastern Idaho and activity at the Idaho National Engineering Laboratory [INL] have been intertwined. The site [INL] was originally established in 1949 as the National Reactor Testing Station, "a place where the U.S. Atomic Energy Commission could build, test, and operate various types of nuclear reactors, allied plant, and equipment with maximum safety."[314] From its inception, the socio-economic impact of the INL complex is statewide, specifically, 70% of their employees live in the Bonneville County, which is considered primary impact area, while

[313] Cornelius A. Hofman, Gary R. Wells, Ronald D. Balsley, and James H. Davis. Center for Business Research & Services Idaho State University, SOCIO-ECONOMIC IMPACTS OF THE IDAHO NATIONAL ENGINEERING LABORATORY (INL), Published April 1986, accessed on 08/24/2022. Pg 01.
[314] Ibid., 5.

smaller numbers live in the Bingham, Bannock, Jefferson, Butte, and Madison Counties. The distribution of employees residing in the aforementioned counties is as follows:

Table IT – 1.

INEL [INL] Employees By County of Residence

May 1984

| County of Residence | Percent of INL Employees | Cumulative Percent. |
|---|---|---|
| Bonneville | 71 | 71 |
| Bingham | 13 | 84 |
| Bannock | 5 | 84 |
| Jefferson | 6 | 95 |
| Butte | 3 | 98 |
| Madison & others | 2 | 100[315] |

Source: Information provided by E.G. & G. Staff – Table 4.4

In 1949, the start-up employee force at the INL was around 200 people, which has grown to 11,500 by the year 1985. The employment growth can be summarized by adding an average of 493 employees per year in the 1950's, by 53 employees per year in the 1960's, and by 417 employees per year in the 1970's. In addition, the employment at the INL for the first half of the 1980's has chosen an increase of 302 employees per year.[316]

In 1985, the INEL[INL] primary and secondary employment – that is, persons employed directly by INEL [INL] and persons employed in jobs that result from INEL activity – accounted for 6.5 percent of total state employment. The INEL dependent population represents 4.7 percent of the state's total population and 21.0 percent of the population in the six-county primary impact area. Almost 57 percent of the population of Bonneville County is INEL-dependent. In addition, INEL [INL] employed 11,515 people directly. This employment created 12,498 additional supportive jobs in the state. The total population supported by INEL is nearly 60,000. INEL [INL] employee households

[315] Ibid., 9.
[316] Ibid.

represent 2.86 percent of the state's population, yet they pay 3.6 percent of the state's sales and personal income taxes. INEL employees account for 5.3 percent of all personal income taxes withheld by the state in 1985. Also, the per person income, sales, and property tax burden is estimated at $618. The per person tax burden for INEL household was $812. INEL [INL] employers were net contributors to the State Unemployment Fund in the amount of nearly $2.1 million. In 1985, INEL [INL] dealt with 900 individuals, businesses, and governmental entities in Idaho.[317]

TABLE IT – 2.

INEL [INL] Employment

1950 – 1985

| Year | Average Monthly Employment |
|---|---|
| 1950 | 375 |
| 1960 | 5,300 |
| 1970 | 5,832 |
| 1980 | 10,003 |
| 1985 | 11,515[318] |

Sources: 1970, 1980, and 1985 figures derived from monthly data provided by the Department of Energy. 1950 and 1960 employment estimated from D.O.E. historical charts. Table 4.5

Table IT-2 shows the relative importance of the INL as a source of job opportunities in the state, the six-county impact area, Bonneville County, and Idaho Falls. In 1950, employment at the INL accounted for a small share of the jobs that were less than 0.2 percent of all jobs in the state and impact area. The INL jobs were less than 0.2 percent of all jobs in the state and equaled just 5.2 percent of employment in Idaho Falls, Idaho.[319] The aforementioned figures in the Table IT – 2 demonstrates that the INL's economic stimulus has been an important socio-economic force in the state and specifically in

[317] Ibid., 1-2.
[318] Ibid., 11.
[319] Ibid., 11.

eastern Idaho. As a result, the INL has become more important to the region because it has created more job openings than any other employer in the area.

Overall, State of Idaho saw a slow growth of jobs in 1950's which saw the creation of new jobs at 13 percent, however, in comparison, there was 28.4 percent increase in new jobs creation in the six-county impact area, and some areas were close to 72.5 percent. This growth in new jobs was primarily due to the expansion of workforce at the INL.[320] The economic data shows that a meaningful socio-economic growth in the six counties adjacent to the INL is due to the economic stimulus generated by various projects and programs at the INL.

TABLE II-3.
EMPLOYMENT IN IDAHO BY AREAS
1950-1985

| YEAR | STATE | PERCENT CHANGE | SIX-COUNTY IMPACT AREA | PERCENT CHANGE | BONNEVILLE COUNTY | PERCENT CHANGE | IDAHO FALLS | PERCENT CHANGE | INEL |
|---|---|---|---|---|---|---|---|---|---|
| 1950 | 205,993 | | 40,017 | | 10,713 | | 7,250 | | 375 |
| 1960 | 232,858 | 13.00% | 51,378 | 28.4% | 17,059 | 59.2% | 12,505 | 72.5% | 5,300 |
| 1970 | 262,277 | 12.60% | 57,422 | 11.8% | 17,835 | 4.5% | 12,750 | 2.0% | 5,832 |
| 1980 | 383,652 | 46.30% | 83,832 | 46.0% | 27,686 | 55.2% | 17,233 | 35.2% | 10,003 |
| 1985 | 403,115 | 5.07% | 88,596 | 5.7% | 31,064 | 14.5% | 18,292 | 6.15% | 11,515 |

Sources: 1950, 1960, 1970, and 1980 Censuses, Characteristics of the Population, Idaho.

1985 figures were obtained from the Idaho Department of Employment.

INEL 1970, 1980, and 1985 figures derived from monthly data provided by Department of Energy. 1950 and 1960 employment estimates from D.O.E. historical charts.

Table 4.6 – Source: 1985 figures from the Idaho Department of Employment. [321]

Table IT-3 describes the dramatic creation of 5,000 new jobs in 1950's at the INL, and majority of them were located in the six-county area. While in the 1960's, employment growth relatively slowed down, in comparison with the 1950's because employment at the INL grew at the rate of 10 percent. Although the INL job growth was higher than Bonneville County and the City of Idaho Falls, it was not higher than other six-county impact area. However, the 1970's saw a 71.5 percent expansion of the jobs at the INL which was 10,103 from 5,832. The job expansion continued into the 1980's, when nearly one out of every eight person in the six-county impact area was working for the INL. Employment as a percent of total employment in the state had risen from 2.2 percent in 1970 to 2.6 percent in 1980 at the INL. Non-agricultural wage salary and employment in

[320] Ibid.
[321] Ibid., 15.

the state was 330,008 in 1980 and the INL employment was 3.0 percent of this total.[322] Interestingly, Table 1.3 infers that from 1950 -1985, the INL employment was roughly three times the Idaho state's average.

The State of Idaho population growth corresponded with the employment trends, and the employment rate grew at 13 percent in the 1950's. However, the Bonneville County's population grew at 21 percent, primarily due to early expansion of the INL, which came out to be 16,696 new employees and their families, and state of Idaho's total population growth was 78,554.[323] The 1960's brought comparatively slower employment growth number of 10 percent at the INL, while the state's population growth was between 7-9 percent. During the 1970's, the state's population grew rapidly, and the population of the six-county impact area grew as fast as the state. Another parameter of economic growth is the income level achieved across the region. In this regard, Bonneville County and City of Idaho Falls for the years 1949, 1959, 1969, and 1979 had relatively high income families, with incomes equal to 120 to 130 percent higher than the statewide median income levels throughout this period. Median family income in Idaho Falls increased by $3,410 in the 1950's compared to a statewide increase of $2,574. Additionally, in the 1970's, median family income in Idaho Falls grew by $8,443 and statewide it grew by $6,904.[324]

There has been substantial employment growth at the INL over the decades. The economic impact of this large employment increase is felt in many industries and regions. According to Idaho Employment Records from 1970 -1999, there has been 2.6% increase in the Bonneville County, which makes it the fifth fastest growing County in the State[325]. Average employment from 1963 to 1985 by the contractors and government agencies at the INL are presented in the TABLE IV-1, which is as follows:

TABLE IV – 1

TOTAL EMPLOYMENT BY CONTRACTORS AND GOVERNMENT AGENCIES AT THE INL 1963 – 1985

| YEAR | CONTACTORS | AGENCIES | TOTAL |
|---|---|---|---|
| 1963 | 4,317 | 1,259 | 5,576 |
| 1964 | 4,534 | 1,374 | 5,908 |

[322] Ibid., 12-13.
[323] Ibid., 13.
[324] Ibid., 14-17.
[325]Total Employment Growth by Decade, Counties of Idaho, 1970-2022 Average Annual Percent Change, 1970-2022. https://idaho.reaproject.org/analysis/comparative-indicators/growth_by_decade/total_employment/tools/, published 2023, accessed 08/20/2023.

| | | | |
|---|---|---|---|
| 1965 | 4,635 | 1,367 | 6,002 |
| 1966 | 4,174 | 1,351 | 5,525 |
| 1967 | 4,473 | 1,334 | 5,807 |
| 1968 | 4,400 | 1,401 | 5,801 |
| 1969 | 4,386 | 1,506 | 5,892 |
| 1970 | 4,288 | 1,544 | 5,832 |
| 1971 | 4,140 | 1,506 | 5,892 |
| 1972 | 4,160 | 1,729 | 5,889 |
| 1973 | 4,098 | 1,965 | 6,063 |
| 1974 | 4,293 | 1,763 | 6,056 |
| 1975 | 4,676 | 1,858 | 6,534 |
| 1976 | 5,228 | 1,833 | 7,061 |
| 1977 | 6,223 | 1,817 | 8,040 |
| 1978 | 7,227 | 1,897 | 9,124 |
| 1979 | 7,639 | 1,960 | 9,599 |
| 1980 | 8,254 | 1,960 | 10,003 |
| 1981 | 7,703 | 1,766 | 9,469 |
| 1982 | 8,201 | 1,731 | 9,932 |
| 1983 | 8,101 | 2,074 | 10,175 |
| 1984 | 9,207 | 1,821 | 11,028 |

| | | | |
|---|---|---|---|
| 1985 | 9,547 | 1,968 | 11,515[326] |

Source: U.S. Department of Energy Employment Reports. Table 4 .7

The INL's economic stimulus not only influenced the Idaho job market, but also encouraged the adjacent communities and the state of Idaho to increase academic and technical skill levels, in order to have a share in the research oriented nuclear industry. In this regard, the E. G. & G (INL contractor) contacted the University of Idaho and Idaho State University to conduct post-secondary educational programs in Idaho Falls. Today, selected bachelor's and master's degrees are offered by the two universities. In 1984, the INL contract provided outlays of over $733,000 and in 1985, it was $309,000 for these educational programs. Furthermore, the Department of Energy reimbursed students for tuition paid in the amount of $214,000 in 1984 and $234,000 in 1985 for a total contribution to education efforts of $947,000 and $543,000 respectively in 1984 and 1985. Due to these generous contributions educational opportunities increased for the eastern Idaho residents.[327] In addition, there is a AGN 201 nuclear reactor at the Idaho State University, Pocatello that was built in 1965 and installed in 1969 with the help of INL resources and it is being used for training purposes. According to Jay Kunze, nuclear engineering professor and reactor administrator at the Idaho State University that "is a great training reactor and ultra-safe, it serves to teach students how to operate a reactor, how to design them, and how to operate them safely. It serves all the purposes for practical training."[328] In 1988, the INL had 10,252 employees, who paid $14.5 million in State Income Taxes withheld from their wages, and they paid an estimated $2.8 million in local property taxes, and $4.8 million in school taxes during the same year.[329] Overall, socio-economic impacts on the state of Idaho are getting clearer as we dig deeper into the facts and figures.

The City of Idaho Falls received a major share of the INL's economic stimulus through growth in infrastructure, housing, retail, and other sectors that reflect these improvements. In 1990, the City of Idaho Falls annexed 431 acres of city land for construction purposes, and the construction costs in 1989 was about $33 million. The land annexation reflects the growth in the single-family residential units, which is the highest since 1978.[330] In addition, by the 1990, there are 9,500 INL related employees who live in the Idaho Falls area. Two of the major INL technical contractors-maintained research offices and laboratories in the city in addition to the INL's testing and research

[326] Ibid., 24.
[327] Ibid., 38.
[328] Idaho State University nuclear reactor turns 50, ISU Marketing and Communications, August 15, 2015, accessed 08/24/2022. https://www.isu.edu/news/2015-fall/idaho-state-university-nuclear-reactor-turns-50.html#:~:text=ISU%20originally%20received%20the
[329] Paul Zelus, Joanne Tokle, & Kenny Bossingham, Socio-Economic Impacts of the Idaho Engineering Laboratory, College of Business, Idaho State University, Pocatello, Published August 1989. Accessed 08/24/2022. Pg 01.
[330] W.R. Gilchrist, Division of Planning and Building, City of Idaho Falls, Population and Growth Package of Idaho Falls January 1990. Growth Package Summary, 01. Published 1990, accessed 08/24/2022.

facilities. Several high technologies "spin off" companies have established research, laboratory, and assembly facilities in Idaho Falls. The INL site has nine program operating areas with a total property value of more than $3.2 billion. About 7,800 workers staff the nine program operating areas on the INL site. The remainder of the work force is stationed in the City of Idaho Falls in six buildings that house administrative, scientific support, and non-nuclear laboratory programs. More than 1,300 employees hold engineering degrees. About 600 have science degrees, mostly physical science, and more than one employee in three has a college degree. Economically, the INL generates approximately $612 million annually in wages and salaries, directly and indirectly and generates more than $50 million in various tax revenues to Idaho.[331] The City of Idaho Falls has the heaviest concentration of technical professionals in the Northern Mountain region, which offers professionals who are interested in a small-town family value and a better place to raise their families.

The INL has had a major economic impact on Bonneville County, which includes the City of Idaho Falls, supporting an estimated 38.0% of all local jobs in 1988. Since the INL is owned and supported by the federal government, the importance of government spending in the County's economy should not be underestimated. Although agribusiness, which includes farming and ranching, wholesale trade in agricultural commodities, food processing, and the manufacturing of farm machinery accounted for about 41% of all jobs in Bonneville County in 1988. In addition, retail sales and employment in retail trade have increased rapidly, reflecting Idaho Falls growing strength as a regional trade center and emphasizing the importance of the economic health of the trade area to the local economy. It is clear that there are more jobs in wholesale trade, retail trade, services, and government jobs. In 1988, the INL has had a major impact on the Bonneville County economy, supporting an estimated 38.0% of all local jobs.[332] The aforementioned information confirms the INL economic stimulus has helped in the growth of the Bonneville County, specifically the City of Idaho Falls through high-tech and government jobs, improvement and development of infrastructure, a measurable increase in retail and service sectors, expansion, and growth of educational and social facilities/institutions.

By 1993, the INL had 11,292 employees, who work in several major facility areas where engineering research and development projects are conducted. There are also several administrative offices and non-nuclear laboratories located in the City of Idaho Falls. Major contractors operate these widespread facilities for the DOE-Idaho Operations Office. Other companies also fill contracts for construction, maintenance, and security services.[333] In addition, women comprise 28% of the INL's workforce. In comparison with the Idaho's labor force, women are underrepresented among the INL professionals, and overrepresented among the INL clerical workers. About half of all INL employees report having no children living at home with them, a proportion which is

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[331] Ibid., 14.
[332] Larry Jacobs & Frank Just. A Social and Economic Profile of Bonneville County and Idaho Falls, Bonneville County Planning Commission, Published February 1990. Accessed 08/24/2022.
[333] Impact: Influences of the Idaho National Engineering Laboratory on the Economic and Community Life of Eastern Idaho published 1993, Idaho DOC-TD, 898.12.12.147,1993. Accessed on 08/24/2022. Pg. 01.

identical to the pattern for the Idaho labor force as a whole. "When INEL [INL] employees were asked to describe the work they perform, their answers spanned a broad spectrum of occupations," such as Waste Management, Health Physics, and Industrial Hygiene = 2,042, Engineering and Architecture = 1,943, Others including Military = 1,859, Administration and Accounting = 1,841, and Communications and Computers = 991.[334] The INL wages and salaries for its 11,292 employees totaled more than $488 million in 1993, with a n estimated income from all sources (including non-INL income) totaling $694 million. Using an average, the typical INL family budget is based on INL wages of $43,304 with a total family income of $61,840. In 1993, the INL households expended more than $403 million on clothing, medical care, and recreation.[335] It is understood that the impact of the INL contractors is extensive, both on their own employees, and on the people and institutions of the state as a whole. In addition, subcontracts awarded to Idaho firms and the donation of equipment to Idaho's schools benefit not only the local communities but the public in general. Beyond direct dollar benefits and contributions, [INL] site employers awarded more than $150 million in subcontracts to Idaho businesses during 1993 and paid $3.8 million in Idaho sales tax during the year. Furthermore, the [INL] site employers are committed to a program of continuing education for their employees. This commitment is underscored by the fact that 1993 tuition benefits to INL site employees totaled more than $5.8 million. Additionally, the INL site employers routinely donate excess computer and laboratory equipment to Idaho's schools, colleges, and universities. The value placed on theses equipment donations during 1993 was $869,000.[336]

As discussed, earlier Bonneville County has the greatest number of INL employees. According to 1994 estimates, 6,483 INL employees reside within the county compose 14% of labor force and 23 % of its total population. There are 14,912 INL employees and their dependents living in the City of Idaho Falls that make up 30% of the city's total population. Other cities with significant proportions of the INL dependent populations are Rigby (42%), Arco (34%), Shelley (#0%), Ammon (30%), Mackay (20%), and Blackfoot (15%).[337] During 1995, the INL employees and their families' earned wages of $572 million. About $435 million of that amount is directly attributable to INL employment. More than $330 million in primarily local expenditures for such basic family items as housing, food, clothing, and transportation are credited to the INL households. Federal government taxes include $69 million in withholding on personal income and $42 million in social security payments. The State of Idaho is estimated to receive about $29 million in personal income tax payments and another $9 million in sales tax on consumer purchases from the 9,340 INL employees and their families. Local jurisdiction, including counties, cities, and school districts, are estimated to receive

[334] Ibid., 2-3.
[335] Ibid., 6-7.
[336] Ibid., 15-16.
[337] Influence of the Idaho National Engineering Laboratory – The Economic And Community Life of Eastern Idaho, INEL [INL] Impacts, Idaho-DOC, TD 898.12.12.154.1995. Published 1995, accessed 08/24/2022.

approximately $10.7 million in property tax payments from the INL households.[338] In addition, taxes and fees are paid to all three government levels. Federal taxes on gasoline, alcohol, and tobacco are estimated to average $367 per family; State gasoline taxes and automatic fees average $603; and local sewer, water, and trash fees average $453 per year.[339] Furthermore, other expenses include investments, college tuition, and discretionary spending for entertainment, the INL families are estimated to have spent about $7,739 on other expenses during 1995, with the total exceeding $66 million. The portion attributable to the INL wages is estimated to be $46 million.[340] In other words, the INL wages and salaries provide a total impact of nearly $600 million per year on eastern Idaho's local economies, and they represent a total employment impact of 18,165 full-time equivalent workers. In addition, the INL employees routinely donated excess computer and laboratory equipment to Idaho's schools, colleges, and universities. In 1995, the estimated value of these donations was $750,000.[341] The aforementioned data and information regarding the INL's socio-economic stimulus and its impact in the adjoining counties is effective and its continuation is in the best interests of the eastern-Idaho residents.

## The 1995 Settlement Agreement

The state of Idaho, after waiting for decades for the federal government to fulfill its promises to dig out, package, and transfer the RNW at the INL to a permanent geologic repository outside of their state. In February 1991, the state of Idaho filed a lawsuit against DOE and *Public Service Company of Colorado v. Batt* No. CV 91-0035-S-EJL (D. Id.) to stop all RNW shipments from their location in Colorado to the INL. The lawsuit details are very lengthy, full of legal technical jargon, definitions, descriptions of areas, and for the sake of space we will only refer to pertinent information here. The aforementioned lawsuit was filed due to a dispute over spent fuel shipments generated by the Fort St. Vrain Nuclear Generating Station in Colorado to the INL for storage at their Irradiated Fuel Storage Facility. Later, in April 1991, Governor Andrus filed a counterclaim to the lawsuit against the United States and sought declaratory and injunctive relief. The State of Idaho pleaded that U.S. government did not obtain an environmental impact permit from the state of Idaho before they started the spent fuel shipments. On June 28, 1993, Senior District Judge Harold Ryan granted Idaho's motion for a summary judgment. All relevant details about the 1993 Court Order are provided in the Appendix because the 1995 Settlement Agreement is eleven pages long, and it has many definitions, notes for specific tasks, dates for certain events, compliance procedures, funding requirements, responsibilities of various government and state agencies, logistical and environmental issues, penalties, and other legal requirements that are not relevant for this space. In addition, the trial transcript is hundreds of pages long, which is not feasible to discuss in its entirety. In order to retain specific court order

[338] Ibid., 6.
[339] Ibid., 7.
[340] Ibid.
[341] Ibid., 12-15.

directives so the meaning does not change, I have put relevant parts of the 1993 District Court trial and 1995 Settlement Agreement documents in the appendix. To end a bitter legal dispute between state and federal governments, both, the U.S. government, and State of Idaho agreed to end litigation and decided to comply with all clauses of this legal binding contract/agreement. This Agreement is a historical document that provides a pathway for the U.S. government and the State of Idaho to understand their obligations, risks, and accountability for their actions and role in the nuclear waste retrievable, storage, packaging, transfer, and disposal at the INL.

The Court Order states that the U.S. government should not send, schedule, or receipt of the RNW shipments to the INL, until they do not provide a comprehensive environmental impact report One of the shortcomings of the Settlement Agreement is that the state of Idaho agreed to allow DOE and U.S. Navy to continue to bring in small quantities of Spent Nuclear Fuel until 2035. In addition, the DOE agreed not to bring certain types of Spent Nuclear Fuel to the INL, and they would continue to work on treating the Spent Nuclear at the INL, and to remove it outside of Idaho for permanent disposal by January 1, 2035. The 65,000 cubic meters of transuranic wastes at the INL would be retrieved and transferred in proscribed volumes by December 2013 to WIPP facility. The foreign nuclear reactors waste coming to the INL will end in year 2000, and at that point it will be discussed/reviewed by the DOE and state of Idaho if it is still necessary to bring in RNW from foreign reactor sources to the INL. This provision was written into the contract, in order to dispel the impression that the INL was a commercial nuclear dump and to restrict the U.S. government agencies to only bring in specified amounts/varieties of RNW to the INL. The Subsurface Disposal Area is a thirty-five acres space within a ninety-seven acres disposal area in the INL complex, and underneath fifteen acres of pits and trenches in this space are the high-grade RNW from the Rocky Flats facility in Colorado, which needs to be retrieved, treated, packaged, and shipped to a permanent facility for disposal outside of Idaho. All liquid wastes need to be treated and turned into a solidified form, so it can be easily transported to permanent storage. The environmental remediation program would continue to preserve the affected areas within the INL complex, so there is no leakage of RNW into the Snake River Aquifer, and the precious water resource is not contaminated with the nuclear waste.

In conclusion, it is important to remember how climate, seismic activity, industrial and mining production, and lumber industries have created an environment where most of the Idaho residents are hesitant to allow business or government entities to expand their waste producing capacities that could be detrimental to their economy, environment, and water resources. The Idaho mine owners and their managers did not take any voluntary measures to reduce water pollution caused by large volumes of tailings and waste generated from various underground mine-operations. Additionally, the federal government failed to act in accordance with the law by not insisting on enforcing improvements in the quality of water ways, implementing water treatment mechanisms in a satisfactory timeframe, and establishing structural organizations. As a result, the water pollution conditions in Coeur d'Alene River did not improve. In 1981, Bunker Hill mines were closed, however, their toxic legacy remains in the Silver Valley and mining districts

in the western Idaho region, while many of the sites are part of the federal government's superfund, which means that these sites are contaminated with hazardous materials and chemicals which needs to be cleaned up for a long time. Furthermore, the INL complex has a variety of radioactive and chemical waste sources that have disposed of large volumes of RNW into the Snake River Aquifer. First, the wastewater streams are directed into disposal wells or percolation ponds, and second, the burying of wastes or above-ground leaks. In 1992, the practice of reprocessing spent fuel at the INL ceased at the INTEC that discharged wastewater directly into the Snake River Aquifer from a 600 feet deep disposal well. Millions of gallons of wastewater, (nearly a million gallons a day, about 21,100 curies of tritium from 1953 to 1988), were disposed of.

In June 1976, two leaks appeared near the abutment on the right side of the newly built Teton Dam in Idaho. While the repair work was being conducted, the dam collapsed creating a 280-foot waterfall, where almost 80 billion gallons of water rushed down the river, overflowing its banks and covering most of the flat lands, farms, buildings, and other structures in its path. There was widespread destruction: 11 people died, drowning 15,000 heads of livestock, and about $1 billion worth of damage was reported. The gushing waters rushed through the INL complex causing minor damage to RNW pits and trenches. Later, Governor Andrus gave the Blue-Ribbon Commission responsibility to look into the environmental impact of the proposed expansion of the INL high-level and transuranic RNW storage and disposal capacity and how the commercial wastes were going to be handled there. The most important question for the state of Idaho residents and political leaders was: what was best for the state of Idaho? The Commission recommended the continuation of important research and interim storage programs at INL, as it would be in the best interests of the national energy policy. Also, the Commission wished to maintain high quality of environment in Idaho for all times, while realizing that the INL has been internationally recognized in the field of nuclear waste management and commercial RNW storage technology and procedures developed there would be used by nuclear waste storage industry. Specifically, the Commission wanted to stop all shipments of nuclear spent fuel from all sources coming to the INL because the reprocessing has created more waste and low-level waste has been injected into the Snake River Aquifer from the INL reprocessing facility.

In addition, there were reports circulating about low-level RNW leakage into the Snake River Aquifer from the INL's waste management program that needed to be fixed. It is clear that various businesses/facilities have been supported and protected by the state of Idaho, even though there were reports of contamination of environment, death of animals, and policies were not followed. In November 1979, John V. Evans, Idaho Governor announced the formation of a Task Force that would review the inefficiencies in the INL's waste management program, and it will provide solutions to the state of Idaho. Specifically, the problem was with several injection wells and seepage ponds in use at the INL for the purpose of disposing of the water contaminated with chemicals and radioactive isotopes. The Task Force estimated that the continued use of disposal wells that discharge directly into the aquifer did create the possibility of an accidental discharge of high-level or concentrated radioactive materials into the aquifer; therefore, all injection

wells should be protected from any accidental discharges. The problem with RNW at the INL was the inconsistency in implementation of the AEC's storage and disposal policies. Plus, the Idaho politicians and residents sensed that the federal government wanted to skirt their responsibility of moving the RNW from the INL complex to a repository outside of the state of Idaho. However, not all Idaho residents were as concerned about the RNW at the INL leaking into the Snake River Aquifer. The INL economic stimulus has a very powerful influence in eastern-Idaho region, specifically, Bonneville, Bingham, Bannock, Jefferson, Butte, and Madison counties. Furthermore, the City of Idaho Falls, Idaho has majority of the U.S. government offices, along with the offices of their agencies and private contractors, and a majority of the INL employees live there. The City of Idaho Falls received a major share of the INL's economic stimulus through growth in infrastructure, housing, retail, and other sectors that reflect these improvements. The INL site has nine program operating areas with a total property value of more than $3.2 billion. About 7,800 workers staff the nine program operating areas on the INL site. The remainder of the work force is stationed in the City of Idaho Falls in six buildings that house administrative, scientific support, and non-nuclear laboratory programs. By 1993, the INL had 11,292 employees, who work in several major facility areas where engineering research and development projects are conducted. It is understood that the INL's socio-economic stimulus and its impact in the adjoining counties is effective and its continuation is in the best interests of the eastern-Idaho residents.

So, if the INL economic stimulus was working well for the Idaho residents, then why did the state if Idaho file a lawsuit against the U.S. government in order to compel them to retrieve and transfer the RNW from their state to a permanent repository? In February 1991, the state of Idaho filed a lawsuit against DOE and Public Service Company of Colorado v. Batt No. CV 91-0035-S-EJL (D. Id.) to stop all RNW shipments from their location in Colorado to the INL. The aforementioned lawsuit was filed due to a dispute over spent fuel shipments generated by the Fort St. Vrain Nuclear Generating Station in Colorado to the INL for storage at their Irradiated Fuel Storage Facility. Later, in April 1991, Governor Andrus filed a counterclaim to the lawsuit against the United States and sought declaratory and injunctive relief. The State of Idaho pleaded that U.S. government did not obtain an environmental impact permit from the state of Idaho before they started the spent fuel shipments. On June 28, 1993, Senior District Judge Harold Ryan granted Idaho's motion for a summary judgment. The district court ordered the United States Department of Energy to prepare an environmental impact statement. Now, the U.S. government was compelled to obtain an environmental report and present it in the Court. Earlier, the state of Idaho had asked U.S. government to obtain an environmental impact report and they had refused to do it. In May 1995, state of Idaho filed a motion to have the U.S. government comply with court order of obtaining an Environmental Impact Report. As a result, the U.S. government agreed to the aforementioned settlement, which does not offer everything that state of Idaho had asked for, however, this Court Order is a major step in the right direction.

## Key points:

. After the Carey mine project was cancelled, the AEC wanted to find temporary storage location
for commercial radioactive waste. The INL was a possible temporary site selected by the AEC.
. Governor Andrus formed a Blue-Ribbon Commission to study the environmental impact due to
the expansion of the INL's storage and disposal capacity due to expected greater volumes.
. The Commission debated what are short and long-term effects of high-level RNW at the INL.
. The duration, cost, and if high-level wastes are more dangerous than the transuranic wastes.
. The farming community was concerned about getting more high-level RNW at the INL, as the
chances of nuclear contamination of the Snake River Aquifer increase.
. It is understood that waste storage and disposal technology has not been created and perfected.
. This is another policy failure if earlier money had been allocated for storage and disposal
systems, by now the specific technology would have been available.
. Members wondered what if the temporary status of the RNW at the INL is actually permanent.
. The AEC promised different Idaho politicians to remove the RNW at the INL once geologic
repository is available for permanent storage and disposal.
. The AEC suffered trust deficit due to various RNW mishaps, lack of accountability, political
manipulation, and varying standards for defense and commercial wastes.
. What was best for Idaho? If higher volume of high-level RNW would add to the risk of
contamination of the Snake River Aquifer or technology will take care of storage problems.
. The RNW glassmaking technology was invented at the INL, which has the potential to grow.
. There is a possibility of an accidental discharge of high-level RNW from INL injection wells.
. In 1979, Task Force presented alternatives to the present INL storage and disposal policies.

. Task Force recommendations were considered economically infeasible, and land utilization at
the INL would be prohibitive.
. The INL generated economic stimulus specifically benefits six counties in eastern-Idaho region.
. The City of Idaho Falls, Idaho houses most of U.S. government offices, employees & families.
. The INL economic stimulus influenced the Idaho job market, but it also increased academic and
technical skill levels, in order to have a share in the research oriented nuclear industry.
. The U.S. government made many promises to state of Idaho to remove the RNW stored and
disposed at the INL outside of Idaho into a permanent repository but they never materialized.
. In 1993, District Court Judge granted Idaho an injunction to stop all RNW shipments to the INL
after it was disclosed that provided environmental impact report was not comprehensive.
. In 1995, the U.S. government and state of Idaho came to a Settlement Agreement, which
required RNW removal from the INL over a period of time, stop certain shipments of wastes,
and assessment of fines and penalties in case of non-compliance or delay.
. The Court Order also compelled U.S. government to pay certain amount of money to state of
Idaho to build a waste treatment facility, establishment of Spent Fuel Laboratory at the INL,
treatment and transfer of wastes at the INL, transuranic shipments to and from Idaho, Spent
Fuel Program, and the Environmental Restoration Program at the INL.
. Now state of Idaho's demand has been highlighted regarding the storage, disposal, retrieval,
shipments, and transfer of RNW from the INL to a permanent repository outside of Idaho.

# Conclusion

In retrospect, the end of Second World War shaped the future of nuclear energy, later, the Cold War fears and anxiety brought new impetus to the safety and economic progress of the U.S. government and American society. The Nuclear Reactor Testing Station was created by the AEC in 1949, today, it is known as Idaho National Laboratory (INL) in the eastern-Idaho desert. The INL became known for its nuclear technological prowess which has produced many useful projects, including commercial nuclear power. The AEC came up with the definition of varieties of RNW, however, the main problem they could not solve was defining, implementation, and completion of comprehensive storage and disposal methods of high-grade RNW. The U.S. atomic bureaucracy was considered aloof and distant from the public domain, which made it hard for many politicians and communities to have access to them and trust their decisions. Many different variations of were formulated and tried at the INL to reduce the volumes of RNW, such as the calcinization of the RNW, formation of solid cement blocks to reduce the space, but the natural radioactive emitting properties could not be weakened into a short period of time. The Western Allies counted on U.S. nuclear weapons program as a shield against the Soviet threat, which created an urgency for the U.S. government to concentrate on the front-end production of nuclear weapons while ignoring the back-end storage and disposal problems. Furthermore, many RNW disasters and accidents across the country caused various American communities to voice their concerns about the AEC's policies regarding storage and disposal of RNW. Idaho residents became concerned about contamination of the Snake River Aquifer by the ever-growing volumes of RNW in trenches, unlined ponds, pits, and other reprocessing facilities that were used to store or dispose of RNW in unsafe manner and conditions.

The U.S. government desired to increase their nuclear technological advantage after the Second World War and provide a nuclear umbrella for their Western Allies against the Soviet hegemonic threat. The Cold War and the detonation of a nuclear weapon by the Soviet Union created an urgency in minds of the U.S. government officials to increase the production of the nuclear weapons. The AEC, the General Advisory Committee, the JCAE, and the nuclear power industry insiders exercised a complete monopoly over nuclear policies and programs for the first two decades. The aforementioned setup in American political and administrative system is considered a subgovernment model of policymaking. The subgovernment consists of midlevel executive agency bureaucrats, congressional committees or subcommittees, and the elite group interested in particular policy formulation and its implementation. The AEC's main goal was the development, production, and control of nuclear technology/energy for defensive and civilian applications, while creating safety and procedural standards for RNW. However, the AEC did not pay precise attention to solving the back-end problems of permanent storage and disposal of the RNW. The proximity of the INL and its ever-growing volumes of RNW to the Snake River Aquifer caused many Idaho residents and

politicians to raise their voices against their state becoming a nuclear dump and the RNW should be removed and transferred to a permanent repository outside of Idaho. Furthermore, the AEC was having problems getting any state to volunteer for an RNW site within their territories. The AEC implemented temporary measures/policies for storage and disposal of RNW, such as sea dumping of nuclear waste. The sea dumping of RNW killed many fish and other marine life and the environment was adversely affected in the Farallon Islands, CA. The West Valley facility, Hanford Reservation, St. Louis, the INL, and many other nuclear waste facilities were leaking wastes into the environment, water, and adjacent properties. Shallow graves were used as a measure to solve RNW storage and disposal problem, and many locations found out the RNW, including plutonium had migrated to adjoining properties and water resources. The INL engineers came up compaction of RNW as a way to reduce the liquid volumes of RNW into a solidified form, which is better for storage space and transportation process. The nuclear industry experts were convinced that the Salt Mine were the best option for a permanent geologic repository for the high-level RNW. The AEC tried to establish a geologic repository at the Carey mine at Lyons, Kansas, but it failed because the Kansas Geologic Survey report cited a large volume of water disappeared in the mine that was being used to clean mine sediments. Most of the Kansas politicians and residents became anxious about a change in the classification of the RNW that was being proposed for storage and disposal at Carey mine. The Carey mine project was cancelled by the U.S. government after severe pressure from Kansas politicians and residents for non-disclosure of dangers and hazards of high-level RNW. All the high-level RNW canisters were brought in from the INL to Kansas was returned back after the abandonment of the Carey mine project. The INL used various methods and innovative processes to store and dispose of the RNW. However, there were severe disagreements about their policy of disposal of nuclear wastes directly into the Snake River Aquifer due to the danger of contaminating it with the nuclear waste.

The AEC presented commercial nuclear energy as the cheapest and most abundant source of energy that would raise the standard of living around the world. The U.S. government gladly presented the benefits of the nuclear energy to their fellow Americans and friends abroad, however, the question of what to do with the nuclear waste from the nuclear weapons program and the commercial nuclear power plants was rarely discussed or answered. By the late 1960s, there were over 129 sites in 39 states where high-level radioactive waste from the nuclear energy power plants and weapons production facilities were stored and disposed of. Earlier, the AEC officials were not bothered about the RNW storage and disposal issues, however, later, as many nuclear power plants became operational, they started generating large volumes of high-level radioactive wastes which became a major source of concern for them. All forms of RNW are hazardous and dangerous which require a comprehensive and verifiable storage, packaging, and disposal mechanism that is economically and administratively viable, and which is reliable for hundreds of years, preferably thousands of years. Most of the RNW at the INL are either high-level or transuranic wastes which are found mostly in liquid form but there are also some wastes that are in solidified or gaseous forms. The classification of these waste has been in dispute for some time and is the subject of litigation. The State of Idaho considers

this waste to be high-level waste, while DOE considers the waste to be mixed transuranic waste. Another major concern at the INL is transuranic waste that has been disposed of in near-surface pits and trenches prior to the practice of retrievable storage for disposal at a permanent federal facility, the WIPP. Idaho residents were not only concerned about the INL being situated on top of the Snake River aquifer but also that the INL administration was using deep disposal wells to inject liquid radioactive wastes directly into the aquifer. Every State in the Union dealt with the nuclear waste issue differently because some generate large volumes of low-level RNW, so their wastes need more storage and disposal area, while others might produce high-grade RNW, but the volume is not as high. The AEC failed in 1971 to establish a geological repository for high-level RNW at Lyons, Kansas. The NAS reviewed AEC's radioactive-waste disposal practices for years and they roundly condemned not only the Idaho operation but the AEC nuclear dumps everywhere they existed. The AEC policy of reprocessing of nuclear spent fuel was controversial, expensive, and created more waste, while did not reduce the RNW radioactivity emitting nature. The worst scenario of proliferation happened when India detonated its first nuclear device in 1974 from reprocessing the RNW from nuclear reactor provided by Canada with an agreement to use only for peaceful purposes. The INL complex reprocessed spent fuel and made it into solidified forms, which made it easier to store, transport, and manage it.

In 1987, the Nuclear Waste Policy Amendment ACT directed the DOE to evaluate only the Yucca Mountain site as the first selected repository for high-level RNW. Finally, in 2009, the aforementioned ad-hoc and schedule-driven changes made by various U.S. administrations regarding the spent fuels/plutonium reprocessing came to a complete halt, when President Barack Obama defunded the commercialization of the nuclear reprocessing. The Low-Level Radioactive Waste Policy Act of 1980 mandated compact agreements negotiated by states in all regions, and a local low-level RNW burial ground is agreed upon, however, due to various political, economic, logistical, and environmental differences the compacts never became a permanent solution. Some states collaborated with others while some tried to have their own nuclear waste policies, while the U.S. government could not assert itself in solving the aforementioned issues. All the utilities were reluctant to provide a long-term storage of low-level RNW, although they knew that there was no high-level RNW repository available in the country which made their nuclear power plant storage a defacto repository for fuel rods/assemblies. In 1975, U.S. government announced an agreement with the State of New Mexico to build a $1 billion facility named Waste Isolation Pilot Plant (WIPP) near Carlsbad, New Mexico, where they would deposit military transuranic waste. The establishment of the WIPP project was good news for the INL, where over 100,000 fifty-five-gallon barrels are stored containing military transuranic waste that are waiting for permanent disposal. Later, the U.S. government desired to have high-level RNW placed at the WIPP facility as an experiment. The U.S. government also wanted to deposit used fuel rods from the nuclear reactors, which the WIPP facility could not accommodate along with transuranic RNW from defense facilities. The U.S. government was still trying to establish a geologic repository for the high-level RNW from nuclear energy power plants. A desirable site will have a low local population density, sufficient available surface water (or, in some cases,

the absence of it) and sub-surface formations that provide security in case of accident. In 1985, the DOE presented a smaller list of three sites in the states of Texas, Washington, and Nevada to President Ronald Reagan.

Specifically, the search for a repository in the east coast by the U.S. government had ended, but a search for a geologic repository in the west continued, while ideas that were previously discarded were also entertained. The politicians and residents of the eastern states decided not to allow a repository in their territories. Later, the U.S. government announced the Yucca Mountain, Nevada was considered the most appropriate location for a high-level RNW repository. However, Nevada officials immediately opposed the geologic repository at the Yucca Mountain site, furthermore, they took several legal, political, and public-relations measures to block DOE actions. By 2001, DOE spent about $4.5 billion to build tunnels and drill bore holes at a thousand feet under the surface at Yucca Mountain. The state of Nevada asked the U.S. government to obtain a permit for the construction and also offer an environmental impact report. The Nevadans were concerned about the economy of their state that relied heavily on the gaming/entertainment industries, which would be adversely affected if there was an RNW accident at Yucca Mountain repository. Later, in 1989, the Nevada legislators passed a bill forbidding any government agency from storing high-level waste in the state, which was actually using their veto against the Yucca Mountain project. Public participation in the nuclear waste policymaking became significantly important as it dealt with the safety and health of the residents, effective design measures, economic impact on the region, and environmental consequences in case of a disaster. The Yucca Mountain project was not the outcome of a systematic site selection process, rather it was a product of political-economic expediency perpetuated by the federal government in order to create a high-level RNW repository in the West coast. In June 2008, DOE submitted an application for a license to establish a high-level repository at Yucca Mountain, however, in March 2010, DOE withdrew their application due to political pressure and public outcry against the project. This was not the first time that the federal government was withdrawing from a nuclear waste repository project, but the withdrawal from Yucca Mountain project will not be forgotten in near future because it was fraught with technical, logistical, environmental, and political issues from the day one. Due to the U.S. government's continued failure to establish a geologic repository, the high-level RNW stored or disposed at the INL would have to wait a little bit longer before they could be transferred to a permanent storage facility outside of Idaho.

The historic 1995 Settlement Agreement provided a detailed roadmap for the U.S. government and state of Idaho to follow and comply with all the provisions that would solve most of the RNW storage and disposal problems at the INL. Some of the items/clauses of the Court Order are of a time-sensitive nature, while others demand verified compliance and impose fines/penalties. Furthermore, the Court restricted the DOE from any further transportation, receipt, processing, and storage of spent nuclear fuel at the INL, until the comprehensive environmental impact statement is completed, reviewed, and any challenges to the statement are resolved. The U.S. government had been using the INL as a nuclear dump since 1960s for its national and international

entities and foreign sources. Since the Cold War era, the U.S. government had been involved in front-end production of nuclear weapons, later, in production of commercial nuclear energy, while the back-end issues were either not considered important or decisions about RNW storage, retrieval, disposal, and permanent repository issues were made on ad-hoc basis. In 1954, the high-level RNW from Rocky Flats, CO was brought in the INL, which started the steady stream of RNW from national and international sources and entities. The residents of Idaho voiced their concerns over the ever-growing volumes of RNW at the INL, and the probability of nuclear contamination of Snake River Aquifer became higher every day. These concerns were exasperated by numerous reports that the INL reprocessing plant had injected nuclear waste/contaminated water into the Snake River. Many Idaho politicians protested against the AEC policies of storage, packaging, and disposal of RNW at the INL. Idaho's main demand was the removal and transfer of all RNW from the INL complex into a permanent repository outside of Idaho.

The U.S. government tried to establish geologic repositories in various states, and they failed many times before succeeding in opening the WIPP facility for transuranic RNW. They tried offering enticements, grants, and high technology jobs, however, none of the states were willing to accept RNW site in their territories. The U.S. government tried seabed dumping, shallow grave disposal, Arctic snow disposal, over the ground containers/tanks, and underground tanks for RNW storage and disposal but all of their efforts proved ineffective, expensive, and futile. The Yucca Mountain project was almost ready for the storage and disposal of high-level RNW; however, the Nevada politicians and residents made it very clear through their actions that they did not want this repository to open for storage and disposal operations. The residents did not trust the AEC because of their pleas for help/support for the treatment of various diseases they acquired due to nuclear bomb testing fall-out. Many states on the east coast announced not to allow any repository in their territories and that is the reason that the U.S. government concentrated on establishing a geologic repository in a state on the west coast. The INL became the most important site in the storage, packaging, and disposal of RNW due to its expansive and isolated location. Even the substantial economic stimulus provided by the INL has not been able sway the politicians nor the residents of Idaho from their demand of retrieving, packaging, transferring, storing, and disposing of the RNW in a geologic repository outside of state of Idaho. The U. S. government had promised in the 1950s that the commercial nuclear energy would be so cheap that it would be hard to meter it. Today, we have experienced that commercial nuclear energy is not cheap because when the clean-up cost of many nuclear contaminated sites, facilities, and areas are taken into consideration, it is far more expensive than the alternatives. In terms of front-end production, the U.S. government has built a formidable arsenal of nuclear weapons, research facilities have recorded many innovations, while the commercial nuclear energy sectors have dwindled down. However, waste management programs in the country are still waiting for a comprehensive high-level RNW storage, packaging, and disposal program in a permanent geologic repository. The Settlement Agreement provides a remedial road map for the U.S. government to follow, while state of Idaho would benefit from it economically and environmentally, the Snake River Aquifer would be safer from the contamination of RNW, and the INL socio-economic

stimulus would continue to strengthen the eastern-Idaho communities. The question for the American society is: are they going to hold the U.S. government responsible for their signed agreements or will our future generations going to deal with the deficiencies in the RNW storage and disposal policies at the INL?

# Appendix

## The Settlement Agreement 1995:

In February 1991, the state of Idaho filed a lawsuit against DOE and Public Service Company of *Colorado v. Batt No. CV 91-0035-S-EJL (D. Id.)* to stop all RNW shipments from their location in Colorado to the INL. The lawsuit details are very lengthy, full of legal technical jargon, definitions, descriptions of areas, and for the sake of space we will only refer to pertinent information here. The aforementioned lawsuit was filed due to a dispute over spent fuel shipments generated by the Fort St. Vrain Nuclear Generating Station in Colorado to the INL for storage at their Irradiated Fuel Storage Facility. Later, in April 1991, Governor Andrus filed a counterclaim to the lawsuit against the United States and sought declaratory and injunctive relief. The State of Idaho pleaded that U.S. government did not obtain an environmental impact permit from the state of Idaho before they started the spent fuel shipments. On June 28, 1993, Senior District Judge Harold Ryan granted Idaho's motion for a summary judgment. The district court ordered the United States Department of Energy to prepare an environmental impact statement and issued the following injunction:

• IT IS FURTHER ORDERED that the Department of Energy should be, and is hereby, ENJOINED from any further transportation, receipt, processing, and storage of spent nuclear fuel at the Idaho National Engineering Laboratory until the comprehensive environmental impact statement is completed, reviewed, and any challenges to the statement are resolved. After various legal maneuvering by the U.S. government, the on June 28, 1993, the district court issued an order requiring the Department of Energy to prepare an Environmental Impact Statement (EIS) regarding the effects on the natural and human environment of "all major federal actions involving the transportation, receipt, processing, and storage of spent nuclear fuel at the Idaho National Engineering Laboratory," and setting forth a reasonable range of alternatives to these actions. *Public Service Co. of Colorado v. Andrus, 825 F. Supp. 1483, 1511 (D. Idaho 1993).* The order also enjoined the Department from transporting, receiving, processing, and storing spent nuclear fuel at the Laboratory until "the comprehensive environmental impact statement is completed, reviewed, and any challenges to the statement are resolved." Id. Finally, the order provided that the district court would retain jurisdiction over the case for the purpose of hearing and resolving disputes between Idaho and the Department "regarding the adequacy of the final environmental impact statement."[342] The Court injunction against any further shipments of any more spent nuclear fuel of any type to the Idaho National Engineering Laboratory [INL] shall remain in full force and effect unless and

[342]United States Court of Appeals, Ninth Circuit. PUBLIC SERVICE COMPANY OF COLORADO, Plaintiff, United States of America, Plaintiff-Appellant, v. Phillip E. BATT, in his official capacity as Governor of the State of Idaho; State of Idaho, Defendants-Appellees. No. 95-35608. Decided: September 28, 1995,
Before EUGENE A. WRIGHT, ALARCON and CANBY, Circuit Judges. Accessed on 05/20/2023.

until [the Department of Energy] issues a record of decision based upon the EIS required by the Order of June 28, 1993, except as follows: [listing permitted shipments].

• The Court continued reviewing and monitoring of all legal actions and counteractions by both parties, and in May 1995, the state of Idaho filed a motion to reopen the proceedings with the district court. The State maintained that the EIS did not comply with the court's order and asserted that the State would challenge the EIS' legal and factual sufficiency. On May 19, 1995, the district court issued an order granting the State's motion. In the order, the court stated that [a]s to the concerns raised by Idaho regarding whether the [June 28, 1993] injunction ordered by [the district court] will remain in effect, the court finds good cause to continue this injunction until this matter is finally resolved. The court noted that the district court's original order of June 1993 indicated that the injunction would remain in effect until the EIS was completed, reviewed, and had challenges against it resolved. On June 1, 1995, the Department issued its record of the decision. On June 27, 1995, the district court issued an order denying the United States' motion. The district court explained that it had continued the injunction because it believed that the original injunction's provision for the district court to resolve disputes regarding the EIS before dissolving the injunction was still in effect. In response to the Department's assertion that urgent national security interests required a lifting of the injunction, a point also pressed on this appeal, the district court established an abbreviated discovery schedule. The court required the briefing to be completed in the district court by September 1, 1995, and stated that the court would render its decision within 30 days thereafter.[343] On May 19, 1995, the district court found that "good cause" existed to extend the injunction that was due to expire ex proprio vigore, upon the issuance of the record of decision by the United States Department of Energy, "no later than June 1, 1995." On August 9, 1993, Idaho and the United States reached an agreement to compromise and settle their legal dispute in this matter. In exchange for the modifications to the June 28, 1993, injunction, the United States agreed to give up the right to appeal or seek other relief from the district court's June 28, 1993, order, or to seek legislation to nullify it, without Idaho's consent.

• Later, on May 17, 1995, prior to the issuance of the record of decision by the United States Department of Energy, Idaho filed a paper styled as a "joint motion to reopen proceedings and for a status conference." Idaho requested that the court immediately schedule a status conference. Idaho alleged in its motion that the environmental impact statement did not comply with the order issued on June 28, 1993, by Judge Ryan. Judge Lodge issued an order on May 19, 1995, without waiting for the United States to reply to the motion for a status conference. Judge Lodge's ex parte order is styled as follows: "ORDER GRANTING JOINT MOTION TO REOPEN PROCEEDINGS: EXTENDING INJUNCTIVE RELIEF: AND REASSIGNING ACTION." (emphasis added). Judge Lodge addressed Idaho's reference to the question whether the injunction issued on June 23, 1993, would be extended beyond June 1, 1995, in the following words: As to the concerns raised by Idaho regarding whether the injunction will remain in effect, the court

[343] Ibid.

finds good cause to continue this injunction until this matter is finally resolved. The court notes that continuation of the injunction has already been mandated by Judge Ryan in his Order Granting Motion for Summary Judgment, Injunction and Administratively Terminating Action, entered June 28, 1993. The court notes that continuation of the injunction has already been mandated by Judge Ryan in his Order Granting Motion for Summary Judgment, Injunction and Administratively Terminating Action, entered June 28, 1993. In that Order, Judge Ryan directed as follows:

• IT IS FURTHER ORDERED that the Department of Energy should be, and is hereby, ENJOINED from any further transportation, receipt, processing, and storage of spent nuclear fuel at the Idaho National Engineering Laboratory until the comprehensive environmental impact statement is completed, reviewed, and any challenges to the statement are resolved. Order Granting Motion for Summary Judgment, Injunction and Administratively Terminating Action, at 3 (filed June 28, 1993) (emphasis added). Based on the foregoing, and the court being fully advised in the premises, IT IS HEREBY ORDERED that the Joint Motion to Reopen Proceedings and Request for Immediate Status Conference, filed by the Governor of the State of Idaho, Phillip E. Batt, and the State of Idaho on May 17, 1995, should be, and is hereby, GRANTED, and this matter is hereby REOPENED. A status conference will be scheduled on the next date available to the court.[344] IT IS FURTHER ORDERED that the injunction imposed on June 28, 1993, shall REMAIN IN EFFECT until otherwise ordered by the court. (emphasis added).

• In his May 19, 1995, order, Judge Lodge made no reference to the stipulation that settled the dispute between the parties. The district court also did not consider the legal effect of the stipulated amendment to the June 28, 1993, order as reflected in the December 22, 1993, order which modified the termination date of the injunction. Judge Lodge did not discuss the import of the amended language that states that the injunction shall remain in effect "until DOE issues a record of decision based upon the environmental impact statement required by the Court's Opinion and Order of June 28, 1993." The district court erred in relying solely on the termination clause of the June 28, 1993, order. The December 22, 1993, modification of the June 28, 1993, order explicitly changed the termination date of the injunction to the day the record of decision is filed. On June 15, 1995, the United States filed a motion for reconsideration of the May 19, 1995, order "extending injunctive relief." On June 26, 1995, the United States filed an appeal from the May 19, 1995, order. The next day, the district court denied the motion for reconsideration. The validity of that order is not before this court. V The majority has concluded that "the 1993 injunction remained in force of its own effect, and that it was not modified or extended by the district court's [May 19, 1995] order." Majority opinion at page 235. While conceding that the language of the December 22, 1993, order "is superficially susceptible to the interpretation the government gives it," the majority has declined to give effect to the December 22, 1993, amendment to the June 28, 1993, order which changed the event that would terminate the life of the injunction. The June 28, 1993, injunction provided that it would be in effect until any disputes concerning the

[344] Ibid.

adequacy of the environmental impact statement had been resolved by the court. In exchange for the agreement of the United States to give up its right to file an appeal, Idaho agreed that the June 28, 1993, injunction would expire upon the filing by the United States of the record of decision.[345]

After many years of litigation and negotiations, a Settlement Agreement was announced in 1995. The State of Idaho, through the Attorney General, and Governor Philip E. Batt in his official capacity; the Department of Energy, through the General Counsel and Assistant Secretary for Environmental Management; and the Department of the Navy, through the General Counsel and Director, Naval Nuclear Propulsion Program, hereby agree on this 16th day of October, 1995, to the following terms and conditions to fully resolve all issues in the actions Public Service Co. of Colorado v. Batt, No. CV 91-0035-S-EJL (D. Id.) and United States v. Batt, No.CV-91-0065-S-EJL (D. Id.): A. Definitions For purposes of this Agreement, the following definitions shall apply:

1. The "State" shall mean the State of Idaho and shall include the Governor of the State of Idaho and the Idaho State Attorney General.
2. The "federal parties" means U.S. Department of Energy (DOE) and the U.S. Department
of the Navy (the Navy), including any successor agencies.
3. "Treat" shall be defined, as applied to a waste, or spent fuel, as any method, technique, or process designed to change the physical or chemical character of the waste or fuel to render it less hazardous; safer to transport, store, dispose of; or reduce in volume.
4. "Transuranic waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.
5. "One shipment of spent fuel" shall be defined as the transporting of a single shipping container of spent fuel.
6. "High-level waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.
7. "DOE spent fuel" shall be defined as any spent fuel which DOE has the responsibility for
managing with the exception of naval spent fuel and commercial spent fuel which DOE has accepted or will take title to pursuant to the Nuclear Waste Policy Act of 1982, 42, U.S.C. 10101 et seq. or comparable statute.
8. "Naval spent fuel" shall be defined as any spent fuel removed from naval reactors as a result of refueling overhauls (refueling) or defueling inactivations (defueling).
9. "Metric ton of spent fuel" shall be defined as a metric ton of heavy metal of spent fuel.
10. "Naval reactors" shall be defined as nuclear reactors used aboard naval warships (submarines, aircraft carriers, or cruisers), naval research or training vessels, or at land-based naval prototype facilities operated by the Naval Nuclear Propulsion Program for the purposes of research, development, or training.
11. "Calendar year" shall be defined as the year beginning on January 1, and ending on December 31
12. "Mixed Waste" shall be defined as set forth in the EIS, Volume 2, Appendix E.

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[345] Ibid.

13. "EIS" shall be defined as the Department of Energy Programmatic Spent Nuclear Fuel
Management and Idaho National Engineering Laboratory Environmental Restoration and Waste Management Program Final Environmental Impact Statement issued April 1995.
14. "ROD" shall be defined as the Record of Decision issued by DOE on June 1, 1995, concerning the EIS.
15. "INEL" shall be defined as the Idaho National Engineering Laboratory [INL].
16. "Running Average" shall mean the total number of shipments of naval spent fuel to INEL, or transuranic waste from INEL, over any period of three years, divided by three.
17. The "Court" shall mean the United States District Court for the District of Idaho before
which is pending *Public Service Company of Colorado v. Batt, No. CV 91-0036-S-EJL* and *United States v. Batt, No. CV 91-0054-S-EJL*, and any appellate court to which an appeal may be taken, or with which an application for a writ of certiorari may be filed, under applicable law.[346]

A. Transuranic Waste Shipments Leaving Idaho:

1. DOE shall ship all transuranic waste now located at INEL, currently estimated at 65,000 cubic meters in volume, to the Waste Isolation Pilot Plant (WIPP) or other such facility designated by DOE, by a target date of December 31, 2015, and in no event later than December 31, 2018. DOE shall meet the following interim deadlines:
a. The first shipments of transuranic waste from INEL to WIPP or other such facility designated by DOE shall begin by April 30, 1999.
b. By December 31, 2002, no fewer than 3,100 cubic meters (15,000 drum equivalents) of transuranic waste shall have been shipped out of the State of Idaho.
c. After January 1, 2003, a running average of no fewer than 2,000 cubic meters per year shall be shipped out of the State of Idaho.
2. The sole remedy for failure by DOE to meet any of these deadlines or requirements shall be the suspension of DOE spent fuel shipments to INEL as set forth in Section K.1.
C. Spent Fuel and High-Level Waste Shipments Leaving Idaho.
1. DOE shall remove all spent fuel, including naval spent fuel and Three Mile Island spent
fuel from Idaho by January 1, 2035. Spent fuel being maintained for purposes of testing shall be excepted from removal, subject to the limitations of Section F.1 of this Agreement.
2. Until all of the aluminum-clad spent fuel then stored at INEL has been shipped to the Savannah River Site, the cumulative number of shipments of spent fuel from the Savannah River Site to INEL under Section D as of the end of any calendar year shall not exceed the cumulative number of shipments of aluminum-clad spent fuel from INEL to the Savannah River Site for the same period.
3. DOE shall treat all high-level waste currently at INEL so that it is ready to be moved

[346] 1995 Settlement Agreement, Idaho Department of Environmental Quality, Idaho National Laboratory Oversight, https://www2.deq.idaho.gov/admin/LEIA/api/document/download/14673, published 1995, accessed 05/28/2022. 1-3.

out of Idaho for disposal by a target date of 2035.

B. Shipments of Spent Fuel to INEL:

The federal parties may transport shipments of spent fuel to INEL only in accordance with
the following terms and conditions.

1. Shipments of naval spent fuel to INEL shall take place as follows:

a. The Navy may make only those shipments of naval spent fuel to INEL that are necessary to meet national security requirements to defuel or refuel nuclear powered submarines, surface warships, or naval prototype or training reactors, or to ensure examination of naval spent fuel from these sources. The Secretary of Defense, upon notice to the Governor of the State of Idaho, shall certify the total number of such shipments of naval spent fuel required to be made through the year 2035.

b. The Navy shall not ship more than twenty-four (24) shipments to INEL from the date of this Agreement through the end of 1995, no more than thirty-six (36) shipments in 1996, and no more than twenty (20) shipments per year in calendar years 1997 through 2000. From calendar year 2001 through 2035, the Navy may ship a running average of no more than twenty (20) shipments per year to INEL. The total number of shipments of naval spent fuel to INEL through 2035 shall not exceed 575. Shipments of naval spent fuel to INEL through 2035 shall not exceed 55 metric tons of spent fuel.

c. Prior to January 1 of each calendar year through the year 2035, the Navy shall provide to Idaho an estimate of the number of shipments and the number of metric tons of naval spent fuel to be shipped during the following calendar year.

d. By January 31 of each calendar year, the Navy shall provide to Idaho the actual number of shipments and actual number of metric tons of naval spent fuel shipped during the preceding calendar year.

e. The naval spent fuel stored at INEL on the date of the opening of a permanent repository of interim storage facility shall be among the early shipments of spent fuel to the first permanent repository or interim storage facility.

f. The sole remedy for the Navy's failure to meet any of the deadlines or requirements set forth in this section shall be suspension of naval spent fuel shipments to INEL as set forth in Section K.1.

2. Shipments of DOE spent fuel to INEL shall take place as follows:

a. If DOE and the U.S. Department of State adopt a policy to accept spent fuel from foreign research reactors into the United States, DOE may send to INEL [INL] a maximum of 61 shipments of spent fuel from foreign research reactors during the period beginning on the date such a policy is adopted and ending on December 31, 2000. The Secretary of Energy, upon notice to the Governor of the State of Idaho, must certify that these shipments are necessary to meet national security and nonproliferation requirements. Upon such certification, DOE may ship not more than 10 such shipments from the date such policy is adopted through December 31, 1996, not more than 20 such shipments from the date the policy is adopted through December 31, 1997, and not more than 40 such shipments from the date the policy is adopted through December 31, 1998.

b. Until such time as a permanent repository or interim storage facility for storage or disposal of spent fuel, located outside of Idaho, is operating, and accepting shipments of spent fuel from INEL, DOE shall be limited to shipments of spent fuel to INEL as set forth in Sections D.2.a., c., d., e., and (f). After a permanent repository of interim storage facility is operating and accepting shipments of spent fuel from INEL, the State of Idaho and DOE may negotiate and reach agreement concerning the timing and number of shipments of DOE spent fuel that may be sent to INEL [INL], in addition to those otherwise permitted under this Section D.2., for preparation for storage or disposal outside the State of Idaho.
c. After December 31, 2000, DOE may transport shipments of spent fuel to INEL [INL] constituting a total of no more than 55 metric tons of DOE spent fuel (equivalent to approximately 497 truck shipments) and subject to the limitations set forth in Sections D.2.e., f., g., and h. below, except the limitations of Section D.2.
a. above will not apply.
d. No shipments of spent fuel shall be made to INEL [INL] from Fort St. Vrain, unless a permanent repository or interim storage facility for spent fuel located outside of Idaho has opened and is accepting spent fuel from INEL, in which case such shipments may be made for the purpose of treating spent fuel to make it suitable for disposal or storage in such a repository or facility. Shipments of spent fuel from Fort St. Vrain shall remain at INEL only for a period of time sufficient to allow treatment for disposal or storage in such a repository or facility. The total number of Fort St. Vrain shipments shall not exceed 244, constituting no more than sixteen (16) metric tons of spent fuel, and shall be in addition to those allowed under Section D.2.c. above.
e. Except as set forth in Section D.2.d. above, DOE will make no shipments of spent fuel from commercial nuclear power plants to INEL.
f. After December 31, 2000, and until an interim storage facility or permanent repository is opened and accepting spent fuel from INEL, DOE shall not ship to INEL [INL]
more than 20 truck shipments of spent fuel in any calendar year, except that:
(i) In one calendar year only, DOE may make not more than 83 truck shipments of spent fuel to INEL from the West Valley Demonstration Project.
(ii) DOE may not make more than 13 truck shipments in any of the nine calendar years succeeding the shipment of the West Valley Demonstration Project spent
fuel to INEL; and 5.
(iii) Shipments DOE is entitled to make to INEL in any calendar year, but has not made, may be shipped in any subsequent calendar year, notwithstanding the limitations in this Section D.2.f. on the number of shipments per year.
For purposes of this section and Section D.2.c., in determining the number of truck shipments, one rail shipment shall be deemed equivalent to 10 truck shipments, except that in the case of shipments from West Valley Demonstration Project, seven rail shipments shall be deemed to be equal to 83 truck shipments. DOE may elect to make rail shipments in lieu of truck shipments, in accordance with this conversion formula and subject to other limitations of this section.
g. Prior to January 1 of each calendar year through the year 2035, DOE shall provide to Idaho an estimate of the number of shipments and the number of metric tons of

DOE spent fuel to be shipped during the following calendar year.
h. No later than January 31st of each calendar year, DOE shall provide to Idaho the actual number of shipments and actual number of metric tons of DOE spent fuel shipped during the preceding year. The sole remedy for DOE's failure to meet any of the deadlines or requirements set forth in this section shall be the suspension of DOE spent fuel shipments to INEL as set forth in Section K.1.

D. Treatment and Transfer of Existing Wastes at INEL [INL]:
1. Treatment Commitment. DOE agrees to treat spent fuel, high-level waste, and transuranic wastes in Idaho requiring treatment so as to permit ultimate disposal outside the State of Idaho.
2. Mixed Waste Treatment Facility. DOE shall, as soon as practicable, commence the procurement of a treatment facility ("Facility") at INEL for the treatment of mixed waste, transuranic waste, and alpha-emitting mixed low-level waste ("Treatable Waste"). DOE shall execute a procurement contract for the Facility by June 1, 1997, complete construction of the Facility by December 31, 2002, and commence operation of the Facility by March 31, 2003. Commencement of construction is contingent upon Idaho approving necessary permits.
a. Treatment of Non-INEL Wastes. Any and all Treatable Waste shipped into the State of Idaho for treatment at the Facility shall be treated within six months of receipt at the Facility, with the exception of two cubic meters of low-level mixed waste from the Mare Island Naval Shipyard which will complete base closure for nuclear work in 1996. DOE may request an exception to the six-month time period on a case-by-case basis, considering factors at the shipping site such as health and safety concerns, insufficient permitted storage capacity, and base or site closures. Any transuranic waste received from another site for treatment at the INEL shall be shipped outside of Idaho for storage or disposal within six months following treatment. DOE shall continue to use the Federal Facility Compliance Act process, as facilitated by the National Governors' Association, to determine what locations are suitable for mixed low-level waste treatment and storage.
3. Operation of High-Level Waste Evaporator. DOE shall commence operation of the high-level waste evaporator by October 31, 1996, and operate the evaporator in such a manner as to reduce the tank farm liquid waste volume by no fewer than 330,000 gallons by December 31, 1997. Efforts will continue to reduce the remaining volume of the tank farm liquid waste by operation of the high-level waste evaporator.
4. Calcination of Remaining Non-Sodium Bearing Liquid Wastes. DOE shall complete the process of calcining all remaining non-sodium bearing liquid high-level wastes currently located at INEL by June 30, 1998.
5. Calcination of Sodium-Bearing Wastes. DOE shall commence calcination of sodium bearing liquid high-level wastes by June 1, 2001. DOE shall complete calcination of sodium-bearing liquid high-level wastes by December 31, 2012.
6. Treatment of Calcined Wastes. DOE shall accelerate efforts to evaluate alternatives for the treatment of calcined waste so as to put it into a form suitable for transport to a permanent repository or interim storage facility outside Idaho. To support this effort, DOE shall solicit proposals for feasibility studies by July 1, 1997. By December 31, 1999, DOE shall commence negotiating a plan and schedule with the State of Idaho

for calcined waste treatment. The plan and schedule shall provide for completion of the treatment of all calcined waste located at INEL by a date established by the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste. Such Record of Decision shall be issued not later than December 31, 2009. It is presently contemplated by DOE that the plan and schedule shall provide for the completion of the treatment of all calcined waste located at INEL by a target date of December 31, 2035. The State expressly reserves its right to seek appropriate relief from the Court in the event that the date established in the Record of Decision for the Environmental Impact Statement that analyzes the alternatives for treatment of such waste is significantly later than DOE's target date. In support of the effort to treat such waste, DOE shall submit to the State of Idaho its application for a RCRA (or statutory equivalent) Part B permit by December 1, 2012.
7. Transfer of Three Mile Island Fuel. DOE shall complete construction of the Three Mile Island dry storage facility by December 31, 1998. DOE shall commence moving fuel into the facility by March 31, 1999, and shall complete moving fuel into the facility by June 1, 2001.
8. Transfer Out of Wet Storage. By December 31, 1999, DOE shall commence negotiating a schedule with the State of Idaho for the transfer of all spent fuel at INEL [INL] out of wet storage facilities. DOE shall complete the transfer of all spent fuel from wet storage facilities at INEL by December 31, 2023. If DOE determines that transfer to dry storage
of any portion of such spent fuel is technically infeasible, or that transfer to such dry storage presents significantly greater safety or environmental risks than keeping the fuel in wet storage, DOE shall inform the State and propose a later date or alternative action. If the State does not agree to such a later date or alternative action, DOE may apply to the Court for appropriate relief. DOE shall, after consultation with the State of Idaho, determine the location of the dry storage facilities within INEL, which shall, to the extent technically feasible, be at a point removed from above the Snake River Plain Aquifer ("Aquifer"). 9. The sole remedy for DOE's failure to meet any of the deadlines or requirements set forth in this section shall be the suspension of DOE spent fuel shipment to INEL as set forth in Section K.1.

F. Spent Fuel Program:
1. Establishment of INEL as DOE Spent Fuel Lead Laboratory. DOE shall, within thirty days of entry of this Agreement as a court order, designate INEL as the Department's lead laboratory for spent fuel. DOE shall direct the research, development, and testing of treatment, shipment and disposal technologies for all DOE spent fuel, and all such DOE activities shall be coordinated and integrated under the direction of the Manager, DOE-Idaho Operations Office. Such designation shall not permit the shipment to INEL [INL] of any spent fuel beyond that permitted by this Agreement with the exception that quantities of spent fuel brought to INEL for testing in excess of those permitted by the Agreement shall leave the State of Idaho within five years of the date of receipt at INEL.
2. Construction of Dry Storage. DOE shall include in its appropriation request for federal fiscal year 1998 to the Executive Office of the President funds necessary for DOE to

initiate the procurement of dry storage at INEL to replace wet, below ground facilities. Spent fuel loading into dry storage shall commence by July 1, 2003.
3. Funding for Dry Cell Expansion Project. The Naval Nuclear Propulsion Program shall include in its appropriation request to the Executive Office of the President for federal fiscal year 1997 funds necessary for the Dry Cell Expansion Project ("Project") at the Expended Core Facility at the Naval Reactors Facility to accommodate removal of excess material and examination of naval spent fuel in a dry condition. The Project shall commence as soon as Idaho Issues the required permit under the Clean Air Act and funding is appropriate. Completion of this project shall result in the expenditure of approximately $26 million dollars over the next five years.
4. Multi-Purpose Canisters. DOE and the Navy shall employ Multi-Purpose Canisters ("MPCs") or comparable systems to prepare spent fuel located at INEL [INL] for shipment and ultimate disposal of such fuel outside Idaho. Procurement shall be performed in accordance with the Federal Acquisition Regulation which ensures that companies in Idaho will have the opportunity to bid on and obtain any competitive contracts for such work. The Record of Decision on the NEPA analysis shall be completed by April 30, 1999.
5. ECF Hot Cell Facility Upgrade. The Naval Nuclear Propulsion Program shall include in its appropriation request for federal fiscal year 1997 to the Executive Office of the President funds necessary to proceed with upgrades which shall require approximately $12 million of expenditures during the next three years.
6. ECF Dry Storage Container Loading Station. The Naval Nuclear Propulsion Program shall include in its appropriation request for federal fiscal year 1997 to the Executive Office of the President funds necessary to proceed with design and construction of a dry storage container loading station at ECF. This project shall require no less than $20 million in expenditures during the next five years.
7. Funding for Discretionary Environmental Remediation Work at the Naval Reactors Facility. The Naval Nuclear Propulsion Program shall undertake environmental remediation efforts at the Naval Reactors Facility totaling approximately $45 million over the next five years.
8. Water Pool Reracking. DOE may proceed with installing new racks into the water pool in the building at the Idaho Chemical Processing Plant Facility currently holding naval spent fuel to provide enhanced capability for spent fuel storage in the existing water pool space until dry storage can be made available. Installation of the new racks may commence as soon as Idaho issues the necessary permit under the Clean Air Act. Idaho shall issue said permit within 180 days after DOE re-submits its application to Idaho.

G. INEL Environmental Restoration Program:
1. INEL [INL] Environmental Restoration Program to Continue. DOE shall continue to implement the INEL environmental restoration program in coordination with Idaho and EPA. Such implementation shall be consistent with the schedules contained in the Federal Facilities Agreement and Consent Order (FFA/CO) entered into with the State of Idaho, EPA, and DOE, and it shall include schedule requirements developed pursuant to the completed and future records of Decision under the FFA/CO. The sole remedies for

failure to implement the environmental restoration activities specified in the FFA/CO shall be those specified in the FFA/CO.
H. Obtaining Timely Federal Funding for Compliance with this Order:
1. Compliance Funding. DOE and the Naval Nuclear Propulsion Program shall share budget information concerning INEL with Idaho prior to submitting the budget request to the Executive Office of the President. Consultations with the State of Idaho shall continue throughout the budget process. The current DOE estimate for the costs of the activities and projects described in Sections A through G over the next five years is approximately $200 million above established budget targets.

I. Federal Funds for this Settlement Agreement:

1. DOE shall provide to the State of Idaho beginning in federal fiscal year 1996 and continuing through 1997-2000, a total amount of $30 million for community transition purposes and any other purposes that are mutually acceptable to the parties, such as the non-Federal development of Boron Neutron Capture Therapy and Radiological Toxicology technology in Idaho.
2. Acoustic Research Funding. The Navy shall include in its appropriation request to the Executive Office of the President for federal fiscal year 1997 no less than $7 million for the Navy to construct a Ships Model Engineering and Support Facility at the Naval Surface Warfare Center, Carderock Division, Acoustic Research Detachment at Bayview, Idaho.[347]
The 1995 Settlement Agreement is eleven pages long, which has many definitions, notes for specific tasks, dates for certain events, compliance procedures, funding requirements, responsibilities of various government and state agencies, logistical and environmental issues, penalties, and other legal requirements that are not relevant for this space. In addition, the trial transcript is hundreds of pages long, which is not necessary to discuss in its entirety. In order to retain specific court order directives so the meaning does not change, I have copied and pasted parts of the 1993 Court trial and 1995 Settlement Agreement. To end a bitter legal dispute between state and federal governments, both, the U.S. government, and State of Idaho agreed to end litigation and decided to comply with all clauses of this legal binding contract/agreement. This Agreement is a historical document that provides a pathway for the U.S. government and the State of Idaho to understand their obligations, risks, and accountability for their actions and role in the nuclear waste retrievable, storage, packaging, transfer, and disposal at the INL.
One of the shortcomings of the Agreement is that the state of Idaho agreed to allow DOE and U.S. Navy to continue to bring in small quantities of Spent Nuclear Fuel until 2035. In addition, the DOE agreed not to bring certain types of Spent Nuclear Fuel to the INL, and they would continue to work on treating the Spent Nuclear Fuel at the INL, and to remove it outside of Idaho for permanent disposal by January 1, 2035.

[347] 1995 Settlement Agreement, Idaho Department of Environmental Quality, Idaho National Laboratory Oversight, 4-7.

# Bibliography

## Archival Collections

Special Collections and Archives, Boise State University Library, (BSUA) Boise, Idaho.
Len B. Jordan Papers, 1962-72.
Frank Church Papers.
Cecil D. Andrus Papers.
Larry LaRocco Papers.

Cornelius A. Hofman, Gary R. Wells, Ronald D. Balsley, and James H. Davis. Center for Business Research & Services Idaho State University, SOCIO-ECONOMIC IMPACTS OF THE IDAHO NATIONAL ENGINEERING LABORATORY (INL), Published April 1986, accessed on 08/24/2022.

Idaho State University nuclear reactor turns 50, ISU Marketing and Communications, August 15, 2015, accessed 08/24/2022. https://www.isu.edu/news/2015-fall/idaho-state-university-nuclear-reactor-turns-50

Paul Zelus, Joanne Tokle, & Kenny Bossingham, Socio-Economic Impacts of the Idaho Engineering Laboratory, College of Business, Idaho State University, Pocatello, Published August 1989. Accessed 08/24/2022.

## Government Documents

Office of Technology Assessment. "Managing the Nation's Commercial High-Level Radioactive
Waste." U.S. Congress, OTA-O-171, March1985, accessed 05 June 2022.Idaho Department of Environmental Quality, "1995 Settlement Agreement: Overview & FAQs," updated October 1995, accessed 04 November 2019. http://www.deq.idaho.gov/inl-oversight-agreement/1995-settlement-agreement/.

Bishop, William P., and C. D. Hollister. A Program on the Ocean Basin Floors and Radioactive
Materials: Data Bases for Assessing Preliminary Concepts, SLA-73-0596, Printed September 1973, Sandia Laboratories.

Bishop, William P. and D. H. Frazier, U.S. Nuclear Regulatory Commission, Proposed Goals
For Radioactive Waste Management, Division of Fuel Cycle and Material Safety U.S. Nuclear Regulatory Commission Washington, D.C. 20555, Manuscript Completed: April 1977. Date Published: May 1978. Idaho Cleanup Project for the for DOE-NE Idaho Operations Office, "Five-Year Review of CERCLA Response Actions at the Idaho National Laboratory," DOE/NE-ID-11201, Revision 3, February 2007. Accessed on 07/21/2022.
https://ar.inl.gov/images/pdf/200702/2007022600146TUA.pdf

Bulletin From The European Community, EURATOM Commission's Report on Community's Nuclear Industries, Information Service, 220 Southern Building., Washington 5, D.C., August-September 1958/NO.31.
By Frank Pitman, United States Atomic Energy Commission, 'High-Level Radioactive Waste Management Alternatives,' Division of Waste Management and Transportation, WASH-1297, Distribution Category UC-70, May 1974.
Committee on Separations Technology and Transmutation Systems - Board on Radioactive
Waste Management - Commission on Geosciences, Environment, and Resources – National Resource Council. Nuclear Wastes: Technologies for Separations and Transmutation, Washington, D.C.: National Academy Press, 1995.
Environmental Defense Institute, INL Contamination and the Snake River Plain Aquifer – The Essentials, US Geological Survey, An Update of Hydrologic Conditions and Distribution of Selected Constituents in Water,. Governor's Blue-Ribbon Commission on Atomic Wastes, Special report, Statement of Policy, Documents Div Idaho State University Library, Pocatello, Idaho. Published 1974. 140008521, accessed on 08/24/2022.
W.R. Gilchrist, Division of Planning and Building, City of Idaho Falls, Population and Growth Package of Idaho Falls January 1990. Growth Package Summary, 01. Published 1990, accessed 08/24/2022
International Atomic Energy Agency, "The Nuclear Fuel Cycle: From the Mining of Uranium to the Disposal of Nuclear Waste," Vienna, Department of Nuclear Energy, 6. Accessed on 09/12/2022, www.iaea.org.
National Research Council, Risk and Decisions: About Disposition of Transuranic and High-Level Radioactive Waste, The National Academies Press: Washington, D.C. 2005.
National Research Council of The National Academies, Research Needs for High-Level Waste: Stored in Tanks and Bins at U.S. Department of Energy Sites (National Academy Press: Washington, D.C. 2001), 22.
Snake River Plant Aquifer and Perched Groundwater Zones, Idaho National Laboratory, Idaho, Emphasis 2006-08, DOE/ID-22212, Report 2010-5197, 2010. (and)
T. M. Beasley, P. R. Dixon, and L. J. Mann, "99Tc, 236U, and 237Np in the Snake River Plain Aquifer at the Idaho National Engineering and Environmental Laboratory," Environmental Science & Technology, 32:3875-3881, 1998.http://www.environmental-defense-institute.org, accessed 05/13/2023.
Radioactive Waste Task Force, Report to the Governor, State of Idaho-John V. Evans, Governor, Published December 13, 1979, accessed 08/24/2022.
Workshop Material For State Review Of USNRC Site Suitability Criteria For High-Level Radioactive Waste Repositories, Manuscript Completed: August 1977, Date Published: September 1977, NUREG-0326, Waste Management Program-Division of Fuel Cycle and Material Safety-Office of Nuclear Material Safety and Safeguards-U.S. Nuclear Regulatory Commission-Washington, D. C. 20555.
Hearings Before The Joint Committee On Atomic Energy, Congress of The United States, Storage And Disposal Of Radioactive Waste, November 19, 1975. U.S. Government Printing Office: Washington, D.C., 1975. #24 (p. 8 – 9).

Hearings Before the Subcommittee on Legislation of the Joint Committee on Atomic Energy: Congress Of The United States, AEC Omnibus Bills For 1963 And 1964, July 17, 1963, U.S. Government Printing Office, Washington, D.C., 1964. 49-50.
J.A. Adam and V.L. Rogers, A Classification System for Radioactive Waste Disposal – What Waste Goes Where? June 1978, Manuscript Completed: June 1978, Division of Fuel Cycle and Material Safety, Office of Nuclear Material Safety and Safeguards, U.S. NRC, Washington, D.C. 20555, NUREG-0456, FBDU-224-10. 181-182.
US Geological Survey, An Update of Hydrologic Conditions and Distribution of Selected Constituents in Water, Snake River Plant Aquifer and Perched Groundwater Zones, Idaho National Laboratory, Idaho, Emphasis 2006-08, DOE/ID-22212, Report 2010-5197, 2010. Accessed 07/21/2022.

## Interviews

Robey, Sarah. Professor of Nuclear Technology and History, Idaho State University, Pocatello,
Idaho, in-person interview, 24th August 2022.
Brailsford, Beatrice. Snake River Alliance (activist), phone interview, 16th February 2016.
Stacy, Susan M. Author: *Proving the Principle*, interview via Zoom meeting on May 05th 2022.

## Legal Archives

1995 Settlement Agreement: Overview & FAQs: Synopsis of Agreement, October 1995, Boise, Idaho, accessed 04 November 2019. http://www.deq.idaho.gov/inl-oversight/oversight-agreement/1995-setlement-agreement/.

Case No. CV 91-035-S-EJL (lead Case), US District Court, Boise, Idaho, "Memorandum Order,"
decision on 7 May 1991, accessed 04 November 2019. http://www.gpo.gov/fdsys/pkg/USCOURTS-idd-1_91-cv-00035/pdf/USCOURTS-idd-1_91-cv-00035-1.pdf.

Aaron Jones. "Ocean Dumping of Nuclear Waste," March 7, 2018, submitted as coursework for PH241, Stanford University, Winter 2017.

Governor's Blue-Ribbon Committee on Atomic Wastes Report, Idaho State University, Office of the President, published on November 6, 1974, 03. Accessed on 08/24/2022.

US Congress, "Nuclear Waste Policy Act of 1982," Washington, D.C. 97th Congress, 20 December 1982 accessed 05 November 2019. http://www.congress.gov/bill/97th-congress/house-bill/3809.

Influence of the Idaho National Engineering Laboratory – The Economic And Community Life of Eastern Idaho, INEL [INL] Impacts, Idaho-DOC, TD 898.12.12.154.1995. Published 1995, accessed 08/24/2022.

Larry Jacobs & Frank Just. A Social and Economic Profile of Bonneville County and Idaho Falls, Bonneville County Planning Commission, Published February 1990. Accessed 08/24/2022.

Impact: Influences of the Idaho National Engineering Laboratory on the Economic and Community Life of Eastern Idaho published 1993, Idaho DOC-TD, 898.12.12.147,1993. Accessed on 08/24/2022

The Hailey City Council Minutes. Beatrice Brailsford Presentation (A Member of Snake River Alliance), June 15, 2015. Accessed on June 17th, 2021.

Report of The Governor's Blue Ribbon Study Committee on Atomic Wastes, Radioactive Waste Management Recommendations, Future, November 6, 1974, 8. Accessed on 05/27/2022.

US Congress, "Summary of the Clean Water Act. 33 U.S.C. & 1251 et seq. (1972)" Laws & Regulations, US Environmental Protection Agency, 1972, accessed 06 November 2019. http:// www.epa.gov/laws-regulations/history-clean-water-act.

United States Court of Appeals, Ninth Circuit. PUBLIC SERVICE COMPANY OF COLORADO, Plaintiff, United States of America, Plaintiff-Appellant, v. Phillip E. BATT, in his official capacity as Governor of the State of Idaho; State of Idaho, Defendants-Appellees. No. 95-35608. Decided: September 28, 1995, Before EUGENE A. WRIGHT, ALARCON and CANBY, Circuit Judges. Accessed on 05/20/2023.

"Teton Dam Failure," The Center for Land Use Interpretation, updated June 2004, accessed 05 November 2019, http://www.geol.ucsb.edu/faculty/sylvester/Teton_Dam/narrative.html.

## Newspapers

*Associated Press,* March 18th, 2022.
*New York Daily News*, 29 March 1979.
*New York Times,* 25 January 1981, May 4, 1993, 2 July 1986, 17 October 1991.
*Paonia (CO) High Country News,* 13 November 1995.
*The Idaho Statesman*, December 13th, 1979, December 15, 1979, December 26th, 1979, January 14th, 1980, March 31st, 2020,
Twin Falls*, Idaho, Times-News*, 11 September 1969, 24 April 1979, 25 October 1988, 2 November 1988, 29 October 1991.
Twin Falls*, The Idaho Registrar,* 12/12/1974.

## Books and Articles

Alley, William M., and Rosemarie Alley, *Too Hot to Touch: The Problem of High-Level Nuclear*
*Waste,* Cambridge: Cambridge University Press, 2013.

Bartlett, L Donald. And James B. Steele, *Forevermore: Nuclear Waste in America.* New York:
W. W. Norton & Company, 1985.
Carter, Luther J. *Nuclear Imperatives and Public Trust: Dealing with Radioactive Waste*. Washington, DC: Resources for the Future, Inc. 1987.
Duffy, Robert J. *Nuclear Politics in America: A History and Theory of Government Regulation*, Lawrence: University Press of Kansas, 1997.
Fradkin, Philip L. *Fallout: An American Nuclear Tragedy.* Tucson: The University of Arizona Press, 1989.
George T. Mazuzan and J. Samuel Walker. *Controlling The Atom: The Beginnings of Nuclear Regulation 1946-1962*. U.S. Nuclear Regulatory Commission: Washington, D.C., 2010.
Gerald, Jacob. *Site Unseen: The Politics of Siting a Nuclear Waste Repository*, Pittsburgh:
University of Pittsburgh Press, 1990.
Iversen, Kristin. *Full Body Burden: Growing Up in the Nuclear Shadow of Rocky Flats*. New York: Crown Publishers, 2012.
Kissinger, Henry A. *Nuclear Weapons and Foreign Policy*, New York: W. W. Norton & Company, 1969.
Lochbaum, David A. *Nuclear Waste Disposal Crisis*. Tulsa, Oklahoma: PennWell Books, 1996.
McCutcheon, Chuck. *Nuclear Reactions: The Politics of Opening a Radioactive Waste Disposal Site.* Albuquerque: University of New Mexico Press, 2002.
McKeown, William. *Idaho Falls: The Untold Story of America's First Nuclear Accident*. Toronto: ECW Press, 2003.
Melfort, Warren S. *Nuclear Waste Disposal: Current Issues and Proposals*, New York: Nova
Science Publishers, Inc. 2003.
Metzger, H Peter. *The Atomic Establishment*. New York: Simon and Schuster, 1972.
Mix, Michael C. *Leaded: The Poisoning of Idaho's Silver Valley*, Corvallis: Oregon State University Press, 2016.
Murray, Thomas E. *Nuclear Policy for War And Peace,* New York: The World Publishing Company, 1960.
National Research Council, *Nuclear Wastes: Technologies for Separations and Transmutation*,
Washington, D.C. National Academy Press, 1996.
Andrew Newman & Gary Nagtzaam. *Decision-Making and Radioactive Waste Disposal.* New
York: Routledge, 2016.
Peterson, Thomas V. *Linked Arms: A Rural Community Resists Nuclear Waste*. Albany: State University of New York Press, 1990.
Rochlin, Gene L. *Plutonium, Power, and Politics: International Arrangements for the Disposition of Spent Nuclear Fuel*, Berkeley, University of California Press, 1979.
James H. Saling and Audeen W. Fentiman. *Radioactive Waste Management.* New York: Taylor

& Francis, 2001.
Stacy, Susan M. *Proving the Principle*. Idaho Operations Office of the Department of Energy: Idaho Falls, Idaho, 1996.
Stobaugh, Robert & Daniel Yergin, *Energy Future: Report of The Energy Project At The Harvard*
*Business School*. New York: Vintage Books, 1983.
Vandenbosch, Robert and Susanne E. Vandenbosch, *Nuclear Waste Stalemate: Political and Scientific Controversies*, Salt Lake City: The University of Utah Press, 2007.
Walker, Samuel J. *The Road to Yucca Mountain: The Development of Radioactive Waste Policy*
*in The United States*, Berkeley: University of California Press, 2009.
Weart, Spencer R. *The Rise Of Nuclear Fear*. London: Harvard University Press, 2012.
Welsome, Eileen. *The Plutonium Files: America's Secret Medical Experiments in the Cold War*,
The Dial Press: New York, 1999.
Howard S. Wheater & Adrian P. Butler, *Biosphere Implications of Deep Disposal of Nuclear*
*Waste: The Upwards Migration of Radionuclides in Vegetated Soils*, London: Imperial College Press, 2007.

## Electronic Resources

Associated Press, Cleanup at West Lake Landfill slowed after more nuclear waste found, spectrum news, St. Louis, Published March 18, 2022, Accessed 08/10/2022. www.spectrumlocalnews.com/mo/st-louis/news/2022/03/18/cleanup-at-west-lake-landfill-slowed-after-more-nuclear-waste-found.
Center for Land Use Interpretation, "Teton Dam Failure Site," accessed 05 November 2019.
http://www.geol.ucsb.edu /faculty/sylvester/Teton_Dam/narrative.html.

Andrew Z. Galarneau, Atomic Fallout, 60 years later Manhattan Project's legacy of radioactive waste, concerns over ex-workers' health remain issues in WNY, *The Buffalo News*, August 5th, 2005. Accessed on 07/15/2022. www.buffalonews.com/news/atomic-fallout-60-years-later-manhattan-projects-legacy-of-radioactive-waste-concerns-over-ex-workers/article.

Hazardous Waste Cleanup: Western New York Nuclear Service Center in West Valley, New York, United States Environmental Protection Agency, Accessed 07/20/2022, EPA.gov https://www.epa.gov/hwcorrectiveactioncleanups/hazardous-waste-cleanup-western-new-york-nuclear-service-center-west.

Total Employment Growth by Decade, Counties of Idaho, 1970-2022 Average Annual Percent Change, 1970-2022. https://idaho.reaproject.org/analysis/comparative-indicators/growth_by_decade/total_employment/tools/, published 2023, accessed 08/20/2023

Mann, Larry J. *Tritium in Ground Water at the Idaho National Engineering Laboratory*, U.S. Geological Survey, updated June 1990, accessed 06 November 2019, Idaho Falls, Idaho.
http://pubs.usgs.gov /wri/1990/4090/report.pdf.
Mark R. Arenaz, US Department of Energy, "Remediation of Buried Waste at the Idaho National Laboratory
Site," WM2010 Conference, March 7-11, 2010, Phoenix, AZ.
http://www.wmsym.org/archives/2010/pdfs/10065.pdf, accessed on 05/21/2023

*Radiationworks: A World of Atomic Oddities*, "The SL-1 Reactor Accident," accessed 07 November 2019. http://www.radiationworks.com.

See Nuclear Waste Disposal, U.S. GOV'T ACCOUNTABILITY OFF., https://www.gao.gov/nuclearwaste-disposal [https://perma.cc/VGL8-GG5E]; see also LANCE N. LARSON, CONG. RSCH. SERV., IF
11201, NUCLEAR WASTE STORAGE SITES IN THE UNITED STATES 1 (2020), https://sgp.fas.org/crs/nuke/IF11201.pdf [https://perma.cc/7KP3-GN52].
See more about Idaho's Settlement Agreement at https://www.deq.idaho.gov/inl-oversight/oversightagreements/1995-settlement-agreement.aspx. Accessed 07/21/2022.

Nick Thompson, Manhattan Project Part 1: Waste From WWII Era Atomic Bombs Left Behind in St. Louis, OzarkFirst.com, Posted: February 9, 2016, Accessed on 08/10/2022. www.ozarkfirst.com/local-news/manhattan-project -part-1-waste-from-wwii-era-atomic-bombs-left-behind-in-st-louis/

US EPA, EPA Superfund Record of Decision: Idaho National Engineering Laboratory (USDOE) 12/01/1995, EPA/ROD/R10-96/147, 1996.
http://www.epa.gov/superfund/sites/rods/fulltext/r1096147.pdf. Accessed 07/21/2022.