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The Study of Yucca Mountain for a possible nuclear storage facility science vs. politics

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**The Study of Yucca Mountain for a possible nuclear storage facility
Science vs. Politics**

**A thesis submitted in partial satisfaction
of the requirement for the degree of
Bachelor of Arts
in**

**Environmental Studies
UNIVERSITY OF NEVADA
Las Vegas**

by

Anna Leske

Spring 1995

Thesis Advisor: Dr. Dennis Soden

ABSTRACT

The study of Yucca Mountain for a possible nuclear storage facility
Science vs. Politics

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Anna Leske

The purpose of this paper is to determine whether scientific or political methods were used by the of the United States Congress in the study of the nuclear waste storage facility in Yucca Mountain, Nevada. The history nuclear power and the history of the Johnston compromise that lead to the elimination of Texas and Washington States as possible sites for the repository is explained. A review of the conflicts between Nevada politicians and the U.S. Congress over the designation of Yucca Mountain as the sole study for a permanent storage site of the nation's high-level nuclear waste is addressed along with the legal maneuvers used to delay the project. The controversy created by Engineering Geologist Szymanski 's study was discussed. The conclusion is that political methods were used to determine that Yucca Mountain, Nevada would be the site to be characterized and science would ascertain whether the site is suitable.

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TABLE OF CONTENTS

ABSTRACT.....	ii
ACKNOWLEDGEMENTS.....	iii
TABLE OF ILLUSTRATIONS.....	v
1. History of the nuclear power industry and disposal legislation.....	1
a. Potential of nuclear power for peaceful use	
b. Prediction of inexpensive electric power	
2. Disposal Legislation.....	3
a. The 1982 Nuclear Waste Policy Act	
b. Congress agreed to study only one site for the repository.	
c. Senator Johnston's compromise gave Nevada the repository	
d. The amended Nuclear Waste Policy Act of 1987	
3.. Nevada politicians criticize Congress actions.....	6.
a. Anger and name calling in the Senate	
5. Political interest groups call for support from the public.....	9.
a. Nevadans oppose study for nuclear storage in Yucca Mountain	

6.	Nevada used the courts in an effort to delay the repository.....	10
	a. Nevada delays air quality permit	
	b. Nevada filed disapproval of site	
	c. Supreme Court denied appeal for "disapproval" case	
7.	Conflicts in the science and technological community.....	16
	a. Nevada Engineering geologist Szymanski's study creates conflicts.	
	b. The U.S. Geological Survey [USGS] disagrees with Szymanski's study	
	c. Researchers from the University of Utah confirms DOE's findings	
	d. A seventeen member panel disagrees with Szymanski	
	e. Legal action with scientific findings	
	f. Independent and foreign experts confirm Szymanski findings	
8.	Bowman and Venneri Blast Theory.....	22
	a. Blast theory technically correct	
	b. DOE Officials criticize Bowman Theory	
9.	Public surveys	24
	a.. Decision Research of Oregon	
	b. Dr. Dennis Soden and Dr. Donald E. Carns	

10. Source of radiation scare..... 26

 a. Dr. Roslyn S. Yellow

11. Political or Scientific Decision 26

TABLE OF ILLUSTRATIONS

CHART 1	INFORMATION RESOURCE MAP
TABLE 1	LIST OF U.S. NUCLEAR POWER PLANTS
CHART 2	LOCATION MAP OF YUCCA MTN. SITE
CHART 3	TRANSPORTATION NETWORK MAP
CHART 4	PROPOSED HIGHWAY AND RAIL ACCESS ROUTES
CHART 5	EARLY ILLUSTRATION OF THE EXPLORATORY SHAFT
CHART 6	EXPLORATORY STUDIES FACILITY DESIGN

History Of The Nuclear Power Industry

One of the most controversial issues of our time is the placement of high-level nuclear waste. The naming of several areas to study for a possible storage site created power struggles and name calling in the halls of congress. The media labeled the public opposition as the NIMBY [not in my back yard] Syndrome. Dr. Rosalyn S. Yalow, the Nobel Prize-winning scientist, said the nations fear of nuclear power is no doubt linked to the bombing of Hiroshima and Nagasaki.

The two atomic bombs dropped on Hiroshima and Nagasaki in August of 1945 created such devastation that it spread terror throughout the world. The realization that this lethal weapon could destroy civilization brought the consequences of war to the forefront of humanity. Immediate national and international control was urgent. The United Nations Atomic Energy Commission was created in January of 1946. President Truman signed THE ATOMIC ENERGY ACT OF 1946 which laid out the United States first domestic policy of nuclear energy development and control. It was rare in the history of science and technology that man had aspired in statutory fashion to govern so thoroughly the forces of a technology prior to its utilization. Among the many questions brought about by this new technology, was the consideration of implementing this new energy for peaceful purposes?

Potential Of Nuclear Power for Peaceful Use

No other single technological innovation possesses as much potential for easing energy shortages around the world. Admiral

Lewis Strauss, the Chairman of the Atomic Energy Commission, stated that atomic power would generate electricity "too cheap to meter" [McCaffrey] As a result of Admiral Strauss and many others belief in the promise of nuclear energy as an endless source of inexpensive electricity, the federal government spent billions of dollars helping the private sector develop nuclear power plants.

Prediction Of Inexpensive Electric Power

The first power plant prototype reactor began operation in Pennsylvania in 1957. Another unit came on line near Chicago in 1959, followed in 1960 by a plant in Massachusetts and one in Michigan in 1962. By December of 1976 a total of sixty reactors were completed in the United States with an additional 146 under construction or on order. However the rapid growth essentially stopped by 1980. Following the accident at Three Mile Island [TMI] in April 1979, the relative stability of attitudes toward nuclear-power-plant construction was disrupted. Immediately before TMI Cambridge Reports found support and opposition at 50 and 32 percent, respectively. Two months after the accident 39 percent were in favor of and 44 percent were opposed to nuclear power plant construction.[Nealey]

The association in the public mind between nuclear power and nuclear weapons made questions of safety for ourselves and our descendants inevitable. Virtually all detrimental effects of nuclear power are associated with radiation. The effects of radiation range from death at high doses to long-term medical effects such as cancer induction and genetic damage at low

radiation doses.

The basic fuel for a nuclear reactor is enriched uranium contained in many hollow metal cylinders called fuel rods. Cooling water flowing in contact with the individual fuel rods carries away the heat and produces steam used in the electric power generator. One facet of nuclear energy which causes extensive concern is the large amounts of radioactive wastes produced. These wastes create an immediate hazard and a threat to future generations. The management of that waste is a scientific and political dilemma.

Disposal Legislation.

Legislation was needed to establish a comprehensive national policy for the disposal of highly radioactive nuclear waste. The nation's nuclear plants use uranium fuel to produce electricity. The used fuel rods were stored in pools of water at reactor sites and many stated they were running out of space. Department of Energy Secretary[DOE] Hazel O'Leary asked for a study to identify sites with the potential for radioactive releases into the environment. The study said the areas needing priority attention were reactor storage pools at the Hanford weapons site near Richland, Wash., the Idaho Chemical Processing Plant, the Savannah River weapons complex in So. Carolina. Reactor fuel is buried in trenches at the Hanford facility and some unlocated canisters are buried somewhere on a 10 acre area at the Oak Ridge, Tenn. weapons complex.

The reactor canisters were designed for only short term storage but have been kept for decades in storage pools made of

concrete which are more likely to leak and do not have effective leak detection. A few of the concrete storage pools are lined with stainless steel which afford more protection. The report included underwater photographs showing deformed canisters and metal sections. In many cases the cladding has rusted, releasing radiation into the water.

Thomas Grumbly, Assistant Secretary for Environmental Restoration, and other DOE officials "have argued that the fuel cannot permanently be kept in the water pools, some of which are more than 40 years old and could eventually leak or be damaged in the event of an earthquake." [Las Vegas Review-Journal Dec.9,1993]

Twenty of the 33 states that have nuclear facilities demanded in a lawsuit June 20, 1994 that the DOE provide a disposal facility for their high level radioactive waste. The dispute involves differing opinions of the 1982 Nuclear Waste Policy. The statute requiring the federal government to remove nuclear waste from the reactor sites to a central facility after 1998.

Energy Secretary Hazel O'Leary said that although the energy department has a moral obligation to take ownership of the waste they are not legally bound until the repository is completed. She says the site will not be ready until 2010. O'Leary then asked for comments on a proposal to compensate the states for storing their waste after 1998. Utilities from states with nuclear facilities are angry about the proposal. They have contributed \$10 billion to the federal government for the repository and demand the DOE take possession after 1998. [Washington Post. 21 June,1994]

The DOE has been searching for potential waste storage sites for many years but "none of the states under consideration wanted the facility, and their representatives generally fought vigorously to prevent one being placed within their borders." [Congressional Quarterly]

The 1982 Nuclear Waste Policy Act

Legislation establishing a national plan for the disposal of highly radioactive nuclear waste was signed into law by President Reagan on Jan. 7, 1983. One of the provisions required the Secretary of Energy "to study five potential sites for the location of a permanent, underground repository and to recommend three of those sites to the president by Jan. 1, 1985, for further site characterization." [Congressional Quarterly]

Under the 1982 law the DOE had narrowed down the search for the first repository to three states: Washington, Texas, and Nevada.

Congress Agreed To Study Only One Site For The Nuclear Waste Repository

Energy Committee Chairman J. Bennett Johnston, a democrat from Louisiana, devised a plan to save money by characterizing only one site. He originally proposed to give incentives to the state accepting a site in the form of "\$50 million per year after signing up for a repository and once it actually began receiving waste, \$100 million per year for the life of the facility." [Congressional Quarterly, 1987]

As Chairman of the Appropriations Subcommittee for Energy and

Water Development Johnston was able to persuade the committee to add the plan to the 1988 appropriations bill. When the appropriations bill reached the floor a filibuster plan by Senator Harry Reid of Nevada and Senator Brock Adams of Washington State was put into effect. Reid and Adams showed astonishing effectiveness on a test vote.

Senator J. Bennett Johnston's Compromise Gave Nevada The Repository

Johnston sought to conquer his opponents by dividing them. He was able to convert Texas and Washington from resistance to support by a stipulation that left only Nevada to house the nation's high level nuclear waste. Texans had insisted on "a stipulation that DOE could not choose a repository site that lay below an aquifer, which could presumably leak into the repository. Their demands had to be heeded. Five of the 21 members of the Energy and Power Subcommittee were from Texas." [Congressional Quarterly, 1987] Both the Texas and Washington sites lay below aquifers, Nevada's did not.

The Amended Nuclear Waste Policy Act Of 1987

The 1982 Nuclear Waste Policy Act was amended on Dec. 17, 1987 and added to the fiscal 1988 deficit-reduction or "reconciliation" bill. House and Senate negotiators agreed on the plan to study only Yucca Mountain, Nevada as the sole site to house the nation's radioactive waste.

Nevada Politicians Criticize Congress Actions

This proposal was criticized by essentially every politician in the State of Nevada. Scientists working for the DOE, become embroiled in a bitter debate about risk to public health. Nevada

politicians vented their anger against Congress with such phrases as, pack of wolves going for the kill, gang rape mentality, base power politics, politically motivated and cowardly, and named the amended act The Screw Nevada Bill.[Congressional Quarterly, 1988].

By using legal appeals Nevada was hopeful of delaying the scheduled opening of the nuclear waste repository. The courts however denied, dismissed, or considered moot most of Nevada's legal appeals. Energy Secretary James D. Watkins threatened the state with a lawsuit to win environmental permits to launch studies at Yucca Mountain.

Overwhelming political opposition, fueled by public perception of enormous risk, creates serious delay for the DOE nuclear waste program. However, the majority of the technical community argues that nuclear waste can be safely disposed of in underground isolation. Engineering geologist Jerry Szymanski, and a few other DOE and U.S. Geological Survey [USGS] researchers disagree.

The controversy surrounding Yucca Mountain is an issue of immense importance to the people of Nevada. The media reports any findings or statements made by scientist, politicians, political interest groups and anyone or anything connected with the Yucca Mountain Project. Today, eight years after Congress proposed sites in three Western states, the words "Yucca Mountain" appear almost daily in the local newspapers.

Anger And Name Calling In The Senate

The political posturing and name calling began in 1986 when the D.O.E. limited the probe for the first nuclear waste repository

to three states: Nevada, Texas, and Washington. Charlie Ivy, Republican Chairman of Clark County, Nevada, claimed Governor Richard Bryan "is obviously trying to politicize the nuclear waste issue to suit his selfish senatorial ambitions." [Las Vegas Sun, 1987,] Gov. Richard Bryan was the most probable challenger for republican Senator Hecht's seat in the next election. Bryan won the Senate seat and Nevada got the nuclear waste repository.

The political battle intensified after the agreement was announced Dec. 17, 1987. Al Swift, Wa.{D.}, commented that forces beyond his control were turning the process from a scientific one to a political one. "We've done it in a purely political process," Swift said, "we are going to give somebody some nasty stuff." [Congressional Quarterly. 1987]

Barbara Vucanovitch complained that no one from Nevada had been allowed to argue for the State's interest or to even participate in the process. She remarked that other states were "gloating" and called the compromise "politically motivated and cowardly. This will turn our state into a federal colony." [Davis, 1987] R-Nev. "Congress is behaving like a pack of wolves going in for the kill." [Congressional Quarterly. 1987.]

Another angry reaction came from Wright H. Andrews, a Washington D.C. lobbyist for Nevada Gov. Richard H. Bryan, "Instead of leadership and principle, it's a gang rape mentality." [Joseph A. Davis, 1987]

Shortly after the agreement is achieved Senator Harry Reid, D-Nevada, is forced to admit defeat. "My disappointment," said

Reid. "is that the House just capitulated." [Congressional Quarterly. 1987.]

Political Interest Groups Call For Support From The Public

Environmental groups and political lobbyist organized public opposition to the repository. Brooks Yeager, a lobbyist for the Sierra Club said the lesson here is, "don't be a representative from a small state." "[Congressional Quarterly. 1988] Citizen Alert, an environmental public interest group, called for state wide support for a scientific rather than a political approach to high level nuclear waste disposal. [Pike, Tara, 1992.]

Senator Bennett Johnston, the driver of the bill, speculated that Nevada would get over its' anger when it remembers the jobs and millions of dollars the dump would bring into the state. Commenting further Johnson said, "If I were a Nevadan living in the real world. I would be happy with this bill. I would bet that in a very few years, Nevada will deem this one of their most treasured industries." [Congressional Quarterly. 1988]

Nevadans Oppose Study for Nuclear Storage In Yucca Mountain

Johnson's prediction was erroneous, Nevadans continue to oppose the Yucca Mountain selection as a permanent nuclear storage site. A Review-Journal/Sun poll shows that 45% of the public strongly support Nevada's political leaders in their fight against building the nuclear waste facility, with only 13% opposed. [Las Vegas Review Journal/Sun, 21 Oct. 1990, sec. B.] The poll did not state how large a survey they conducted.

The Las Vegas Review /Journal Editorial pages are filled with

support for Nevada politicians and opposition to the repository. "Much to the dismay of some politicians and federal bureaucrats, Nevada did not roll over and play dead. The struggle now enters the Federal courts. D.O.E. should brace itself for a spirited battle - one of many the feds can expect as long as they insist on a crude political solution to a complex scientific problem." [The Review/Journal, 1990]

Nevada Used The Courts In An Effort To Delay The Repository

Nevada still has several possible avenues of action. The chosen state has a right to veto, but that could be overridden by the congress, and that appeared to be more than likely. The environmental permits needed for the geological studies at Yucca Mountain could be stalled, or Nevada could take the issue to court. Nevada decided to use the permits and the courts to retard the progress of the Federal Government.

The DOE is required to obtain state-issued permits to study Yucca Mountain. At least 18 permits/approvals are required by the DOE for various stages of site characterization work. Eleven of the permits are state issued and seven other permits/approvals are granted by various federal agencies.

In early 1988 and 1989, DOE applied for three state issued permits. The two most vital of the three permits, air and water, would allow site disturbing work to begin at Yucca Mountain.

Nevada Delays Air Quality Permit

The DOE originally filed for the air quality permit on June 20, 1988. The State of Nevada delayed taking final action on the

air quality permit until June 12, 1991. An air quality permit normally takes up to 90 days to process.

In connection with the permits issue, two separate lawsuits were filed in the federal court between the state of Nevada and the federal government.

Nevada Filed Disapproval Of The Site

The first case was filed by the State of Nevada in the U.S. Ninth Circuit Court of appeals in January 1990 petitioning that the D.O.E. stop work at Yucca Mountain because Nevada had disapproved the site. In September of 1990 the Ninth Circuit Court ruled in D.O.E.'s favor.

Nevada filed an appeal to the U.S. Supreme Court in December of 1990. The U.S. Supreme Court denied the petition for review on March 4, 1991. Therefore, declaring the Ninth Circuit Court decision stand.

The DOE had filed for air quality, water appropriation, and underground injection control with various state agencies. The permit applications had been returned by the state without final action. The U.S. Department of Justice filed a lawsuit in U.S. District Court against the State of Nevada on January 25, 1990 pursuing an order to get the state to act upon the three permit applications. The case was stayed on March 23, 1990, until the Ninth Circuit Court ruled in the "Disapproval" case.

In September 1990, the Ninth Circuit Court ruled in favor of the DOE in the "Disapproval" case. In October 1990, the U.S. filed a motion for summary judgment and requesting an order for the

state to take final action on the permits.

The State filed a separate motion for a further stay pending an appeal to the Supreme Court or for additional time to study the summary judgment. The U.S. District Court granted the state's motion for additional time to respond on December 14, 1990. The State filed its opposition to the motion for summary judgment in January 1991. The U.S. replied to the States opposition within the same month.

Supreme Court Denied Appeal For "Disapproval" Case

In early March 1991 the Supreme Court denied the State's petition for appeal in the "Disapproval" case thereby closing the case. In the U.S. District Court in Las Vegas on March 20, 1991 a hearing was held on the U.S.'s motion for summary judgment. The judge asked that the two sides reach a stipulation that the pending applications be processed on their merits in accordance with state law. The judge required final action on the air quality permit take place within 75 days and within state regulatory time frames on the underground injection control permit. A hearing date was set for July 17, 1991 on the status of the water appropriation permit.

The two sides were unable to reach a stipulation by the set date. Therefore, on May 13, 1991 the judge ordered that final action on the underground injection control and air quality permits take place by July 17, 1991.

The state issued the air quality permit on June 12, 1991. on June 13, 1991 the state announced that a public hearing for the

water injection control permit was set for July 16,1991. The state engineer held a pre-hearing conference on the water appropriation permit. He ruled that an "evidentiary hearing" would be held in Las Vegas on September 24,1991. The underground injection control permit was issued on July 17,1991, the next day after the public hearings were held.

The U.S. District Court Judge in Las Vegas dismissed two parts of the case pertaining to the two permits already issued on July 17,1991, in a status hearing. He retained jurisdiction over the third permit. He also set another status hearing on the state's progress in processing the third permit for November 20,1991.

Other court cases include the Right-of-Way Case, Guidelines case, and Environmental Assessments case. The U.S. Supreme Court denied the State of Nevada's petition to review a Ninth Circuit Court of Appeals case, on May 20,1991, involving the Bureau of

Land Management's granting of a right-of-way to the DOE to perform site characterization activities on about 50,000 acres of public domain land in the Yucca Mountain area. The Ninth Circuit Court of appeals had upheld a U.S.District Court decision to dismiss the case on jurisdictional grounds. This case is now closed.

Numerous parties, including the State of Nevada, filed suit in the Ninth Circuit challenging the guidelines issued in December,1984, relating to the nomination and assessment of potential sites for a high-level nuclear waste repository in agreement with a provision of the 1982 Nuclear Waste Policy Act. However, the suits of most of the parties were dismissed after the

1987 amendments to the Nuclear Waste Policy Act directing the study of only Yucca Mountain, Nevada.

The State of Nevada filed against the DOE on May 29, 1985, charging that some of the criteria of the guidelines are not in conformance with the Nuclear Waste Policy act. The federal government countered that nothing in the Act precludes the qualitative nature of the guidelines and that all individually challenged guidelines are within the scope of the statute. The U.S. Ninth Circuit Court of Appeals held with the federal government and dismissed the case on July 17, 1991.

On August 28, 1991, the Ninth Circuit Court of Appeals held that the state of Nevada claims of defects in a DOE environmental assessment of the Nevada site, while other locations were still under review, became irrelevant in 1987 when Congress removed the other sites from consideration. The appeals court turned down a series of challenges by Nevada, ruling that state must wait for Yucca Mountain to be named as the permanent repository site before using its legal authority to veto the site, an action that Congress could override.

On May 28, 1986, Nevada filed suit against the DOE challenging the sufficiency of an environmental assessment on Yucca Mountain. The Ninth Circuit Court on April 1990, ordered both sides to present arguments on the questions of whether the Yucca Mountain environmental assessment had become "moot" in view of the 1987 amendment to the Nuclear Waste Policy Act directing the study of only Yucca Mountain, and whether the environmental assessment

adequately addressed certain considerations of the amended act.

March 14, 1991. the State of Nevada argued in its brief, the environmental assessment for Yucca Mountain is not moot, and that the amended act still requires the preparation of an adequate assessment as a "pre-condition" to the conduct of site characterization. The state also challenged many assumptions and conclusions made in the environmental assessment. The federal government insisted that by directing the DOE to study only Yucca Mountain, Congress had overridden the original statutory purpose of the environmental assessment, and therefore, the document is no longer significant in the site evaluation process. The federal government also maintained that any review of the conclusions in the environmental assessment is unwarranted because the 1987 amendments now regard that site characterization will reveal whether Yucca Mountain is a satisfactory site. [DOE,project office]

Using the courts, Nevada politicians had created delays and gained hope. Barbara Vucanovich said in a speech before the Nevada Legislature, "By using all its legal appeals, Nevada will be successful in keeping the high-level nuclear waste dump out of Yucca Mountain." [Vogel,1990] Energy Secretary James D Watkins announced a seven year delay in the opening of the repository, pushing the deadline to 2010.

Virtually every politician in the State of Nevada had debated the process of the selection of Yucca Mountain as the nuclear repository. Now scientists, working for the DOE, are embroiled in

a bitter debate about risk to public health.

Conflicts In The Science And Technological Community

The conflicts in the arena of science and technology began with a study by Las Vegas Engineering Geologist Jerry Szymanski, an acknowledged expert in nuclear plant siting, with a master's degree from the University of Warsaw. Szymanski's study of the Yucca Mountain Project revealed veins of carbonate and silicate minerals that he believed showed signs of upwellings of water through Yucca Mountain.

The debate revolves around a 322 page management report Szymanski submitted to the DOE and a copy sent to a contact in the Nevada state government. The Szymanski report was then forwarded to the governor who released it to the press, claiming a DOE coverup. Szymanski denied there was a coverup.

Nevada Engineering Geologist Szymanski's Study Creates Conflicts

Szymanski's theory is that "tectonic and convective forces beneath Yucca Mountain are so volatile that they could rearrange the geology of the site in a relatively short time, during the 10,000-year lifetime of the repository." [Science, 1991] Szymanski thinks an earth quake could send a surge of groundwater from deep within the mountain to the nuclear waste storage area. The hot canister would then "produce steam and possibly break, leaking radionuclides to the outside world." [Science, 1991]

Szymanski's theory has gained meager support and some open hostility. The comments by Brent Dalrymple are an illustration of the hostile attitudes of the U.S. Geological Survey. Dalrymple

writes that "dozens of scientists have reviewed [Szymanski's] work and have found little merit in it." Dalrymple also claimed Szymanski had avoided conventional avenues for testing his hypotheses and achieving scientific support and "released his findings to the popular press and to those politicians eager to be rid of any disposal site." [Science,1991]

William Dudley of the Denver U.S. Geological Survey, national laboratories and more than twenty project scientists completed and internal evaluation of Szymanski's report. Dudley announced, "We found the evidence unconvincing or clearly wrong. In many instances there was selective use of data out of context." [Science,1991]

Sandia and Lawrence Livermore National Laboratories created mathematical models to show the long term maximum changes up or down will not be more than "tens of meters."

Issac Winograd of the U.S. Geological Survey says that historic records indicates that no earthquake has shifted the water table by more than about 10 meters in this area of the Southwest and even these fluid excursion don't last longer than about a year. "Szymanski tends to ignore geologic time," says Winograd. [Science,1991]

Seismologist Charles Archambeau of the University of Colorado says "he knows of two earthquakes that produced over a cubic kilometer of fluid-in Japan and near the Nevada-California border--within the past 25 years by seismic pumping." [Science,1991]

The U.S. Geological Survey[USGS] Disagrees With Szymanski's Study

Federal geologists have been studying Yucca Mountain since 1987 and have long known that at least one fault cuts through the region. The U.S. Geological Survey started an exceptionally fine scale mapping program in 1992. Richard W. Spengler with the USGS "and his colleagues report the Ghost Dance fault zone, as the principal fault running through the proposed repository area. The Ghost Dance "has several parallel strands extending across a width of 215 meters. This feature, called the runs north-south, as do most of the faults around Yucca Mountain" [Science News. 14 May, 1994] Spengler and his colleagues discovered The Sundance fault after working on the Ghost Dance fault. The Sundance is a "zone of parallel faults that trend northwest-southwest through Yucca Mountain." [Science News. 14 May, 1994]

Even if these faults are not active fractured rocks filling these faults could provide an avenue for groundwater to reach the repository. However, the faults could contain natural mineral cement that inhibits water flow. Spengler says, "The basic question that remains unanswered is whether or not any of the faults are barriers to the transport of fluids and gases or whether they are conduits." [Science News. 14 May, 1994]

Neville Price taught structural geology at Imperial College, London maintains that "The structures of the veins that I saw in trench 14 and elsewhere are like the veins I have seen in mountains in areas around the world...One can explain them in terms of periodic upwelling of fluids."

Researchers From The Univ. of Utah Confirm DOE's Findings

Thure Cerling and Jay Quade University of Utah researchers have a different explanation for the high elevation mineral deposits. They published their evidence that rainwater is source of the deposits in Science, 14 December, 1990,p.1549. " By sampling deposits where the source of water is well known, they established a set of isotope values that they could use to identify carbonates created by deep groundwater, those created by trapped or 'perched' water at a high elevation, and those created by rainwater. They then demonstrated that carbonates in trench 14 match up with local perched or rain water deposits and not with the groundwater deep below Yucca Mountain."

Charles Archambeau, a geophysicist with the university of Colorado, disagrees. He says there is no reason present-day ground water beneath Yucca Mountain must match trench 14 carbonates. He says " in the past, when these carbonates were formed, Yucca Mountain may have been gushing with groundwater of a different kind--the kind that is typical of a Szymanski source zone."

A Seventeen Member Panel Disagrees With Szymanski

A seventeen member panel of experts on Coupled Hydrologic/Tectonic/Hydrothermal Systems at Yucca Mountain assembled by the National Research Council[NRC]. unanimously reject a 1987 claim by a dissident DOE geologist Jerry Szymanski. The Panel concluded "... There is no evidence to support the assertion that the water table has risen periodically hundreds of meters from deep within the crust [during the past 100,000 years]. In fact, the evidence

strongly supports a surface-process origin from rainwater for [the deposits]." This 240 page report was released April of 1992.

Legal Action With Scientific Findings

The State of Nevada filed suit on June 14, 1993 against the DOE, the Nuclear Regulatory Commission, the Environmental Protection Agency, and the officials who head those agencies regarding the Federal Governments study of Yucca Mountain, Nevada as a possible site for a nuclear waste repository. The state pursues a court order to authorize the Attorney General's Office to take depositions of Yucca Mountain project scientist who were involved in the review of former DOE scientist Jerry Szymanskis assertion that groundwater levels at Yucca Mountain had risen in the past to the level of the proposed repository site and could probably do so again.

The Case of Nevada v. O'Leary [Energy Secretary Hazel O'Leary] No. 93-17367, 1993, 9th Circuit Court, involves Nevada's petition to take the depositions of 27 scientist who reviewed

reports regarding the hydrothermally driven water hypothesis, which, if true, would disqualify the Yucca Mountain site. The petition was denied by the District Court and is awaiting oral argument on appeal.

In 9th Cir. court, Case No. 94-70148, Nevada v. O'Leary Nevada invoked the original jurisdiction of the Court of Appeals to challenge DOE's failure to adequately characterize the nature and origin of calcite-silica deposits in Trench 14 at Yucca Mountain.

Independent U.S. And Foreign Experts Confirm Szymanski Findings

Szymanski claims that calcium carbonate and opal veins exposed in exploratory trench 14 is clear evidence that ground water has once covered most of the hillside, leaving behind some thick mineral deposits.

A report gathered by independent U.S. and foreign experts on geochemistry and hydrology essentially confirms the position of former Yucca Mountain Project geologist Jerry Szymanski. The report determined that minerals from deep within the crust were carried to the surface by warm springs and not deposited by rainwater as Utah researchers Thure Cerling and Jay Quade claim. The experts included Carol Hill, an independent geologist from Albuquerque, New Mexico, Russel Harmon, United Kingdom Natural Environment Research Council geochemist, Curtis Monger, a geologist and specialist in arid soils at New Mexico State University, Professor J. Hoefs of the University of Gottingen, Germany and Jerry Szymanski. They were under a \$500,000. contract between a Colorado Technology and Resource Assessment Corp. and the Nevada Nuclear Projects Agency. The agency monitors the Federal Yucca Mountain project. [Las Vegas Review Journal/Sun, 29 Jan, 1994]

Moid Ahmad, Ohio State University professor with doctorate degrees in hydrology and geophysics, states that if Yucca Mountain becomes the nation's nuclear waste dump, earthquakes and volcano's could destroy the repository. He also warns that it won't take an earthquake or volcano to boost the water into the nuclear dump site and pollute the groundwater. He believes as the climate becomes

wetter "that deep water flowing southwest from Idaho and Utah across Nevada could rise as more rain and snow falls in the West during the next 5,000 to 10,000 years..... the Southwest's future water will come from this deep ground water, not the Colorado River". [Las Vegas Sun. 22 March, 1994]

Jeremy M. Boak, Geologist, Yucca Mountain Project writes that Moid Ahmad's report lacked serious research into the groundwater flow system in Southern Nevada. "Otherwise he would have known that deep groundwater does not flow from Idaho across the entire state of Nevada, nor does groundwater from the Yucca Mountain area come anywhere near Pahrump. The groundwater system which underlies Yucca Mountain discharges at Franklin Lake playa, and is separated by a groundwater divide from the Pahrump Valley... The water table rise required to invade the repository is beyond any creditable effect of climate or tectonic activity, according to a National Academy of Sciences panel which included 17 experts in the appropriate fields." [Las Vegas Sun. 7 April, 1994] Mr. Boak also chastised the University of Nevada Las Vegas[UNLV] Environmental Studies Lecture Series claiming a need "to diversify beyond the consistently anti-nuclear tone of its speakers.' He proposes "Inviting a wider range of viewpoints would validate its claim to be engaging in an open discussion of the issue of nuclear waste disposal, and would bring credit to the university for providing a valuable public service." [Las Vegas Sun. 7 April, 1994]

Bowman and Venneri Blast Theory

Los Alamos National Laboratory physicists Charles Bowman and

Francesco Venneri authored a paper that says a "criticality, or nuclear chain reaction would be possible if containers of spent fuel rods or glass logs of plutonium from dismantled nuclear weapons are entombed in Yucca Mountain." Bowman said if the canisters are breached and if materials spread inside the mountain, a nuclear explosions similar to a below ground nuclear test could happen, but anything like a mushroom cloud is not likely. [Batt]

Blast Theory Technically Correct

Paul Parks, scientist for Westinghouse Savannah River Co., a contractor at the government's nuclear weapons plant in So. Carolina, said the Bowman theory about radioactive waste exploding in a nuclear chain reaction inside a repository like the one proposed at Yucca Mountain is technically correct. A 16 page report by Park and two other scientist, lee Hyder and Thomas G. Williams, said their evaluation relies on the "premise that the waste would be plutonium from dismantled nuclear weapons, which has not been proposed for storage at Yucca Mountain. "It's entirely weapons-grade plutonium. We're not talking anything about fuel at all." [Rogers]

DOE Officials Criticize Bowman Theory

Department of Energy officials have critized Bowman and Venneri because it focuses on disposal of pllutonium from nuclear warheads and only liquid defense wastes that have been turned into glass logs and spent reactor fuel have been considered for Yucca Mountain. [Rogers]

Public Surveys

Both political infighting and debates within the scientific community continue to this date. Public attitudes, opinions, and perception remain uniformly negative. A Telephone survey of more than 2500 residents of Nevada and Southern California revealed that "73.6% of Nevadans said that the state should continue to do all it can to oppose the repository even if it means turning down benefits that may be offered by the federal government." [Science, 1991]

A Study by Decision Research of Oregon revealed that 69 percent of the 625 Nevadans surveyed by telephone remain opposed to the high level nuclear repository at Yucca Mountain. Robert Loux, director of the state's Nuclear Waste Project Office said the study cost about \$5,000. [Las Vegas Sun. 11 Feb., 1994]

A poll conducted by Dr. Dennis Soden and Dr. Donald E. Carns, highly respected professors of University of Nevada Las Vegas, between May 1 and May 5 show that 55.0% of Nevadans

support the study of Yucca Mountain and the concept of benefits for Nevada. The poll also indicates:

"* Nevadans are primarily concerned that the study carefully address safety and health impacts.

* Over 60 percent of those surveyed believe nuclear energy and technology should be a part of the energy future.

* Yucca Mountain is not a major concern for most Nevadans who are more concerned about crime related issues, water, growth, overpopulation, the economy, and education." [Dr. Dennis Soden]

Paula Brown, co-chair of The Study Committee, a Nevada

citizens group said " The irony in this poll is that if our elected officials were willing to discuss benefits with the federal government, some of the major problems now facing our state as well as major opportunities could be addressed. We could discuss a world-class scientific research institution at UNLV and UNR, additional water rights for Nevada, securing federal funding to improve our schools or to combat crime....It is clear. We expect a change in the way our political leaders approach the study of Yucca Mountain." [Dr. Dennis Soden]

Eddie Watson founded the African-Americans in Favor of Yucca Mountain Studies. The Las Vegas Sun opposes the study and Watson said they attacked him as an "educated nitwit, an Uncle Tom, a puppet for the nuclear industry, a money grubber and a murderer." The people in the community knew Watson was one of the "Thousand Points of Light" volunteers honored by former President Bush. A

4-H Club board member, a church worker with the homeless, and a recruiter for the National Association for the Advancement of Colored People. He also works full time at the test site.

"The [people in this community] know my heart--I've been working for so long to make life better for people," he says. "As people read that story, they began to say, 'Something isn't right with this. Why are they lying?'" Watson said that people began to think that maybe opponents were telling other lies, maybe about the waste. He decided to get more information. Through the Nevada Nuclear Waste Study Committee he met scientist who gave him a detailed explanation of the project.

Watson states "The Nevada Test Site is the best place for the waste, because no one in the world knows more about radioactive materials than we do." [First Quarter, 1994]

Source Of Radiation Scare

Dr. Rosalyn S. Yalow Nobel Laureate, spoke on "Radiation and Society" at the University of Nevada, Las Vegas. She said everyone was so afraid of the word "Nuclear." The answer likely involves the bombings of Hiroshima and Nagasaki. No matter how much proponents try to separate the peaceful from the weapons atom, the connection is firmly ingrained in the minds of the public. Dr. Yalow pointed out that we live with radiation every day, the average dose of natural and man made sources is around 360 millirems [MREM] a year. She said the Jet flight to speak in Las Vegas had added another 2 mrem and watching TV would add another 0.6 mrem per hour. This particular scientist seemed to

have a way of separating the panic from the word "nuclear" and leaving the awareness and respect, much like one would respect a poisonous snake. The audience was sparse. If more Nevadans had come to hear Dr. Yalow speak they would have gotten another view of the nuclear picture. Good decisions are formed by listening to both sides of an issue.

Political Or Scientific Decision

My purpose is to discover if the Congressional decision to place the nation's nuclear waste in the bowels of Yucca Mountain was made by political or scientific reasons. Now that I have shown the conflicts within the political arena and the scientific

community, it is evident that both science and politics played a part in the decision. I believe that I have shown that politics was the determining factor in designating Yucca Mountain as the site to study for a possible repository. However, I believe, Scientific investigation and characterization will determine whether Yucca Mountain can safely house high level radioactive waste. I say this because this project is highly visible. Nevada politicians and the DOE alike keep this issue in the public eye and interest with extensive press releases as a means of distributing their arguments for and against the repository. The media prints anything that hints at Yucca Mountain.

The DOE has published a 3 1/2 inch, 3 volume, environmental assessment[EA]. This EA assesses everything from geological, hydrology, radiological, geohydrology, geochemistry, tectonics, socioeconomic, archaeological, cultural and historical resources. I have another 5 inches of Site Characterization Plan and subsequent Site Characterization Progress Reports and Overview also published by the U.S. DOE. I have another stack of material from the State of Nevada, Agency For Nuclear Projects, including a very nice booklet on "Why Nevada is Opposed to Yucca Mountain. Above all of that I have files of newspaper clipping and magazine articles. The point that I want to make here is, that if there is a problem with Yucca Mountain I can't see how the DOE could hide it even if they wanted to.

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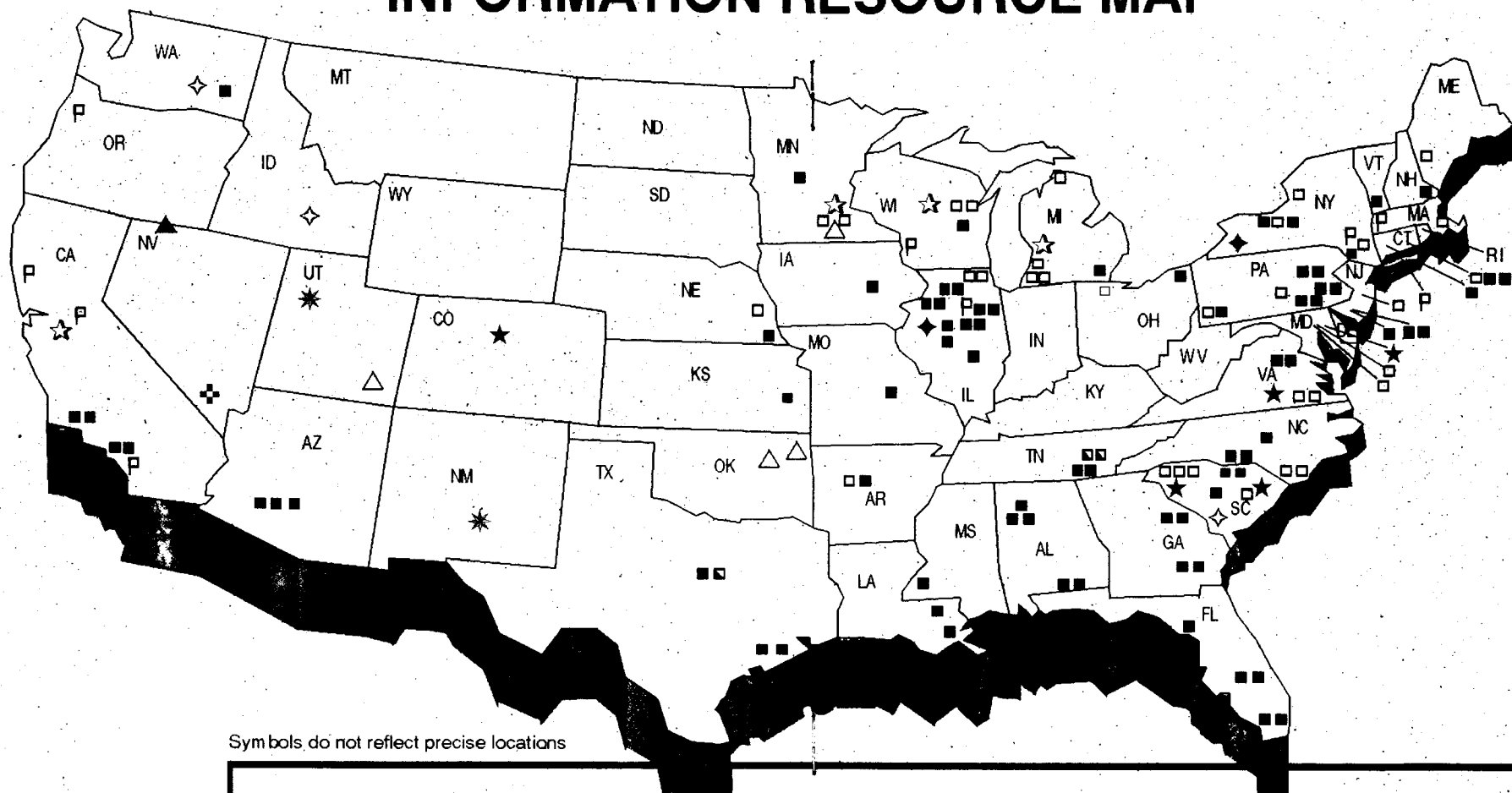
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OFFICE OF CIVILIAN RADIOACTIVE WASTE INFORMATION RESOURCE MAP



Symbols do not reflect precise locations

- | | |
|--|--|
| ■ Commercial Nuclear Reactors | ☆ Planned Dry Assembly Storage |
| ⊕ Site Characterization Studies | ◇ Defense High-Level Radioactive Waste Storage |
| △ MRS Feasibility Grants - Phase I | ◆ Commercial High-Level Radioactive Waste Storage |
| ▲ MRS Feasibility Grants - Phase IIA Pending | □ Reactor Storage Pools Exceeding Capacity Before 1998 |
| ✱ MRS Feasibility Grants - Phase IIA | ▣ Planned Reactors |
| ★ Spent Fuel in Dry Assembly Storage | ⌘ Shut Down Reactors with Spent Fuel on Site |

World List of Nuclear Power Plants, cont'd

	Net MWe	Type	Con- struc- tion stage (%)	Ini- tial- ity	Operation com- mer- cial start	Reactor Supplier	Generator Supplier	Architect Engineer	Constructor
United States									
Alabama Power Co.									
• Joseph M. Farley 1 (Dothan, Ala.)	824	PWR	100	8/77	12/77	W	W	Utility/Bechtel Utility/Bechtel	Daniel Daniel
• Joseph M. Farley 2 (Dothan, Ala.)	830	PWR	100	5/81	7/81	W	W		
Arizona Public Service Co.									
• Palo Verde 1 (Wintersburg, Ariz.)	1221	PWR	100	5/85	1/86	C-E	GE	Bechtel Bechtel Bechtel	Bechtel Bechtel Bechtel
• Palo Verde 2 (Wintersburg, Ariz.)	1221	PWR	100	4/86	9/86	C-E	GE		
• Palo Verde 3 (Wintersburg, Ariz.)	1221	PWR	100	10/87	1/88	C-E	GE		
Arkansas Power & Light Co.									
• Nuclear One 1 (Russellville, Ark.)	836	PWR	100	8/74	12/74	B&W	W	Bechtel Bechtel	Bechtel Bechtel
• Nuclear One 2 (Russellville, Ark.)	858	PWR	100	12/78	3/80	C-E	GE		
Baltimore Gas & Electric Co.									
• Calvert Cliffs 1 (Lusby, Md.)	825	PWR	100	10/74	5/75	C-E	GE	Bechtel Bechtel	Bechtel Bechtel
• Calvert Cliffs 2 (Lusby, Md.)	825	PWR	100	11/76	4/77	C-E	W		
Boston Edison Co.									
• Pilgrim (Plymouth, Mass.)	670	BWR	100	6/72	12/72	GE	GE	Bechtel	Bechtel
Caroline Power & Light Co.									
• Brunswick 1 (Southport, N.C.)	790	BWR	100	10/76	3/77	GE	GE	UE&C UE&C	Brown Brown
• Brunswick 2 (Southport, N.C.)	790	BWR	100	3/75	11/75	GE	GE		
• Robinson 2 (Hartsville, S.C.)	665	PWR	100	9/70	3/71	W	W	Ebasco Ebasco	Ebasco Daniel
• Shearon Harris (New Hill, N.C.)	660	PWR	100	1/87	5/87	W	W		
The Cleveland Electric Illuminating Co.									
• Perry 1 (North Perry, Ohio)	1141	BWR	100	6/86	11/87	GE	GE	Gilbert Gilbert	Utility Utility
• Perry 2 (North Perry, Ohio)	1205	BWR	57	.....	indef.	GE	GE		
Commonwealth Edison Co.									
• Braidwood 1 (Braidwood, Ill.)	1120	PWR	100	5/87	7/88	W	W	S&L S&L	Utility Utility
• Braidwood 2 (Braidwood, Ill.)	1120	PWR	100	3/88	10/88	W	W		
• Byron 1 (Byron, Ill.)	1105	PWR	100	2/85	9/85	W	W	S&L S&L	Utility Utility
• Byron 2 (Byron, Ill.)	1105	PWR	100	1/87	8/87	W	W		
• Dresden 2 (Morris, Ill.)	772	BWR	100	1/70	6/70	GE	GE	S&L S&L	Utility UE&C
• Dresden 3 (Morris, Ill.)	773	DWR	100	1/71	11/71	GE	GE		
• LaSalle County 1 (Seneca, Ill.)	1036	BWR	100	6/82	1/84	GE	GE	S&L S&L	Utility UE&C
• LaSalle County 2 (Seneca, Ill.)	1036	BWR	100	3/84	10/84	GE	GE		
• Quad Cities 1 (Cordova, Ill.)	769	BWR	100	10/71	2/73	GE	GE	S&L S&L	Utility UE&C
• Quad Cities 2 (Cordova, Ill.)	769	BWR	100	4/72	3/73	GE	GE		
• Zion 1 (Zion, Ill.)	1040	PWR	100	6/73	12/73	W	W	S&L S&L	Utility Utility
• Zion 2 (Zion, Ill.)	1040	PWR	100	12/73	9/74	W	W		
Connecticut Yankee Atomic Power Co.									
• Haddam Neck (Haddam Neck, Conn.)	565	PWR	100	7/67	1/68	W	W	S&W	S&W
Consolidated Edison Co.									
• Indian Point 2 (Indian Point, N.Y.)	849	PWR	100	5/73	8/74	W	GE	UE&C	Wedco
Consumers Power Co.									
• Big Rock Point (Charlevoix, Mich.)	67	BWR	100	9/62	3/63	GE	GE	Bechtel Bechtel	Bechtel Bechtel
• Palisades (South Haven, Mich.)	768	PWR	100	5/71	12/71	C-E	W		
Detroit Edison Co.									
• Fermi 2 (Newport, Mich.)	1093	BWR	100	6/85	1/88	GE	GEC	Utility	Daniel
Duke Power Co.									
• Catawba 1 (Clover, S.C.)	1129	PWR	100	1/85	6/85	W	GE	Utility Utility	Utility Utility
• Catawba 2 (Clover, S.C.)	1129	PWR	100	5/86	8/86	W	GE		
• McGuire 1 (Cornelius, N.C.)	1129	PWR	100	8/81	12/81	W	W	Utility Utility	Utility Utility
• McGuire 2 (Cornelius, N.C.)	1129	PWR	100	5/83	3/84	W	W		
• Oconee 1 (Seneca, S.C.)	846	PWR	100	4/73	7/73	B&W	GE	Utility/Bechtel Utility/Bechtel Utility/Bechtel	Utility Utility Utility
• Oconee 2 (Seneca, S.C.)	846	PWR	100	11/73	9/74	B&W	GE		
• Oconee 3 (Seneca, S.C.)	846	PWR	100	9/74	12/74	B&W	GE		
Duquesne Light Co.									
• Beaver Valley 1 (Shippingport, Pa.)	810	PWR	100	5/76	10/76	W	W	S&W S&W	S&W/Utility Utility
• Beaver Valley 2 (Shippingport, Pa.)	833	PWR	100	8/87	11/87	W	W		
Florida Power and Light Co.									
• St. Lucie 1 (Hutchinson Island, Fla.)	839	PWR	100	4/76	12/76	C-E	W	Ebasco Ebasco	Ebasco Ebasco
• St. Lucie 2 (Hutchinson Island, Fla.)	839	PWR	100	6/83	8/83	C-E	W		
• Turkey Point 3 (Florida City, Fla.)	666	PWR	100	10/72	12/72	W	W	Bechtel Bechtel	Bechtel Bechtel
• Turkey Point 4 (Florida City, Fla.)	666	PWR	100	6/73	9/73	W	W		
Florida Power Corp.									
• Crystal River 3 (Red Level, Fla.)	821	PWR	100	1/77	3/77	B&W	W	Gilbert	Jones

Georgia Power Co.									
• Edwin I. Hatch 1 (Baxley, Ga.)	757	BWR	100	9/74	12/75	GE	GE	Utility/Bechtel	Utility
• Edwin I. Hatch 2 (Baxley, Ga.)	768	BWR	100	7/78	9/79	GE	GE	Bechtel	Utility
• Alvin W. Vogtle 1 (Waynesboro, Ga.)	1063	PWR	100	3/87	6/87	W	GE	Utility/Bechtel	Utility
• Alvin W. Vogtle 2 (Waynesboro, Ga.)	1063	PWR	100	3/89	5/89	W	GE	Utility/Bechtel	Utility
GPU Nuclear Corp.									
• Oyster Creek (Forked River, N.J.)	620	BWR	100	5/69	12/69	GE	GE	B&R/GE	B&R
• Three Mile Island 1 (Londonderry Twp., Pa.)	806	PWR	100	6/74	9/74	B&W	GE	Gilbert	UE&C
Gulf States Utilities Co.									
• River Bend (St. Francisville, La.)	936	BWR	100	10/85	6/86	GE	GE	S&W	S&W
Houston Lighting & Power Co.									
• South Texas Project 1 (Palacios, Tex.)	1250	PWR	100	3/88	8/88	W	W	Bechtel	Ebasco
• South Texas Project 2 (Palacios, Tex.)	1250	PWR	100	3/89	6/89	W	W	Bechtel	Ebasco
Illinois Power Co.									
• Clinton (Clinton, Ill.)	930	BWR	100	2/87	4/87	GE	GE	S&L	Baldwin
Indiana/Michigan Power Co.									
• Donald C. Cook 1 (Bridgman, Mich.)	1020	PWR	100	1/75	8/75	W	GE	Utility	Utility
• Donald C. Cook 2 (Bridgman, Mich.)	1060	PWR	100	3/78	7/78	W	B&C	Utility	Utility
Iowa Electric Light & Power Co.									
• Duane Arnold (Palo, Iowa)	538	BWR	100	3/74	2/75	GE	GE	Bechtel	Bechtel
Louisiana Power & Light Co.									
• Waterford 3 (Taft, La.)	1075	PWR	100	3/85	9/85	C-E	W	Ebasco	Ebasco
Maine Yankee Atomic Power Co.									
• Maine Yankee (Wiscasset, Me.)	830	PWR	100	10/72	12/72	C-E	W	S&W	S&W
Nebraska Public Power District									
• Cooper (Brownville, Neb.)	764	BWR	100	2/74	7/74	GE	W	B&R	B&R
New Hampshire Yankee									
• Seabrook (Seabrook, N.H.)	1150	PWR	100	6/89	/90	W	GE	UE&C	UE&C
New York Power Authority									
• James A. FitzPatrick (Scriba, N.Y.)	757	BWR	100	11/74	7/75	GE	GE	S&W	S&W
• Indian Point 3 (Indian Point, N.Y.)	965	PWR	100	4/76	8/76	W	W	UE&C	Wedco
Niagara Mohawk Power Corp.									
• Nine Mile Point 1 (Scriba, N.Y.)	610	BWR	100	9/69	12/69	GE	GE	Utility	S&W
• Nine Mile Point 2 (Scriba, N.Y.)	1072	BWR	100	5/87	4/88	GE	GE	S&W	S&W
Northeast Utilities									
• Millstone 1 (Waterford, Conn.)	654	BWR	100	10/70	3/71	GE	GE	Ebasco	Ebasco
• Millstone 2 (Waterford, Conn.)	863	PWR	100	10/75	12/75	C-E	GE	Bechtel	Bechtel
• Millstone 3 (Waterford, Conn.)	1142	PWR	100	1/86	4/86	W	GE	S&W	S&W
Northern States Power Co.									
• Monticello (Monticello, Minn.)	536	BWR	100	12/70	6/71	GE	GE	Bechtel	Bechtel
• Prairie Island 1 (Red Wing, Minn.)	503	PWR	100	12/73	12/73	W	W	FEI	Utility
• Prairie Island 2 (Red Wing, Minn.)	500	PWR	100	12/74	12/74	W	W	FEI	Utility
Omaha Public Power District									
• Fort Calhoun (Fort Calhoun, Neb.)	478	PWR	100	8/73	6/74	C-E	GE	G&H	G&H
Pacific Gas & Electric Co.									
• Diablo Canyon 1 (Avila Beach, Calif.)	1073	PWR	100	4/84	5/85	W	W	Utility	Utility
• Diablo Canyon 2 (Avila Beach, Calif.)	1087	PWR	100	8/85	3/86	W	W	Utility	Utility
Pennsylvania Power & Light Co.									
• Susquehanna 1 (Berwick, Pa.)	1032	BWR	100	9/83	6/83	GE	GE	Bechtel	Bechtel
• Susquehanna 2 (Berwick, Pa.)	1038	BWR	100	5/84	2/85	GE	GE	Bechtel	Bechtel
Philadelphia Electric Co.									
• Limerick 1 (Pottstown, Pa.)	1055	BWR	100	12/84	2/86	GE	GE	Bechtel	Bechtel
• Limerick 2 (Pottstown, Pa.)	1055	BWR	100	8/89	1/90	GE	GE	Bechtel	Bechtel
• Peach Bottom 2 (Peach Bottom, Pa.)	1051	BWR	100	9/73	7/74	GE	GE	Bechtel	Bechtel
• Peach Bottom 3 (Peach Bottom, Pa.)	1035	BWR	100	8/74	12/74	GE	GE	Bechtel	Bechtel
Portland General Electric Co.									
• Trojan (Prescott, Ore.)	1085	PWR	100	12/75	5/76	W	GE	Bechtel	Utility
Public Service Electric & Gas Co.									
• Hope Creek (Salem, N.J.)	1031	BWR	100	6/86	12/86	GE	GE	Bechtel	Bechtel
• Salem 1 (Salem, N.J.)	1106	PWR	100	12/76	6/77	W	W	Utility	UE&C
• Salem 2 (Salem, N.J.)	1106	PWR	100	8/80	10/81	W	GE	Utility	UE&C
Rochester Gas & Electric Corp.									
• R. E. Ginna (Ontario, N.Y.)	470	PWR	100	11/69	7/70	W	W	Gilbert	Bechtel

South Carolina Electric & Gas Co.									
• Virgil C. Summer (Parr, S.C.)	885	PWR	100	10/82	1/84	W	GE	Gilbert	Daniel
Southern California Edison Co. and San Diego Gas & Electric Co.									
• San Onofre 1 (San Clemente, Calif.)	436	PWR	100	6/87	1/88	W	W	Bechtel	Bechtel
• San Onofre 2 (San Clemente, Calif.)	1070	PWR	100	7/82	8/83	C-E	GEC	Bechtel	Bechtel
• San Onofre 3 (San Clemente, Calif.)	1080	PWR	100	8/83	4/84	C-E	GEC	Bechtel	Bechtel
System Energy Resources, Inc.									
• Grand Gulf (Port Gibson, Miss.)	1142	BWR	100	8/82	7/85	GE	Alis	Bechtel	Bechtel
Tennessee Valley Authority									
Bellefonte 1 (Scottsboro, Ala.)	1213	PWR	89	.....	indef.	B&W	B&C	Utility	Utility
Bellefonte 2 (Scottsboro, Ala.)	1213	PWR	58	.....	indef.	B&W	B&C	Utility	Utility
• Browns Ferry 1 (Decatur, Ala.)	1085	BWR	100	8/73	8/74	GE	GE	Utility	Utility
• Browns Ferry 2 (Decatur, Ala.)	1085	BWR	100	7/74	3/75	GE	GE	Utility	Utility
• Browns Ferry 3 (Decatur, Ala.)	1085	BWR	100	8/76	3/77	GE	GE	Utility	Utility
• Sequoyah 1 (Soddy-Daisy, Tenn.)	1148	PWR	100	7/80	7/81	W	W	Utility	Utility
• Sequoyah 2 (Soddy-Daisy, Tenn.)	1148	PWR	100	11/81	6/82	W	W	Utility	Utility
Watts Bar 1 (Spring City, Tenn.)	1177	PWR	100	.....	10/91	W	W	Utility	Utility
Watts Bar 2 (Spring City, Tenn.)	1177	PWR	85	.....	indef.	W	W	Utility	Utility
Texas Utilities Electric Co.									
Comanche Peak 1 (Glen Rose, Tex.)	1150	PWR	100	.....	7/90	W	Alis	G&H	Brown
Comanche Peak 2 (Glen Rose, Tex.)	1150	PWR	86	.....	/92	W	Alis	G&H	Brown
Teledyne Edison Co.									
• Davis-Besse (Oak Harbor, Ohio)	874	PWR	100	8/77	7/78	B&W	GE	Bechtel	Bechtel
Union Electric Co.									
• Callaway (Fulton, Mo.)	1125	PWR	100	10/84	12/84	W	GE	Bechtel	Daniel
Vermont Yankee Nuclear Power Corp.									
• Vermont Yankee (Vernon, Vt.)	504	BWR	100	3/72	11/72	GE	GE	Ebasco	Ebasco
Virginia Power Co.									
• North Anna 1 (Mineral, Va.)	915	PWR	100	4/78	6/78	W	W	S&W	S&W
• North Anna 2 (Mineral, Va.)	915	PWR	100	6/80	12/80	W	W	S&W	S&W
• Surry 1 (Gravel Neck, Va.)	781	PWR	100	7/72	12/72	W	W	S&W	S&W
• Surry 2 (Gravel Neck, Va.)	781	PWR	100	3/73	5/73	W	W	S&W	S&W
Washington Public Power Supply System									
WNP-1 (Richland, Wash.)	1250	PWR	85	.....	indef.	B&W	W	UE&C	Bechtel
• WNP-2 (Richland, Wash.)	1095	BWR	100	1/84	12/84	GE	W	B&R	Bechtel
WNP-3 (Richland, Wash.)	1240	PWR	75	.....	indef.	C-E	W	Ebasco	Ebasco
Wisconsin Electric Power Co.									
• Point Beach 1 (Two Rivers, Wis.)	485	PWR	100	11/70	12/70	W	W	Bechtel	Bechtel
• Point Beach 2 (Two Rivers, Wis.)	485	PWR	100	5/72	10/72	W	W	Bechtel	Bechtel
Wisconsin Public Service Corp.									
• Kewaunee (Carlton, Wis.)	503	PWR	100	3/74	6/74	W	W	FEI	FEI
Wolf Creek Nuclear Operating Corp.									
• Wolf Creek (Burlington, Kans.)	1135	PWR	100	5/85	9/85	W	GE	Becht/S&L	Daniel
Yankee Atomic Electric Co.									
• Yankee (Rowe, Mass.)	167	PWR	100	8/60	7/61	W	W	S&W	S&W

• Units in commercial operation

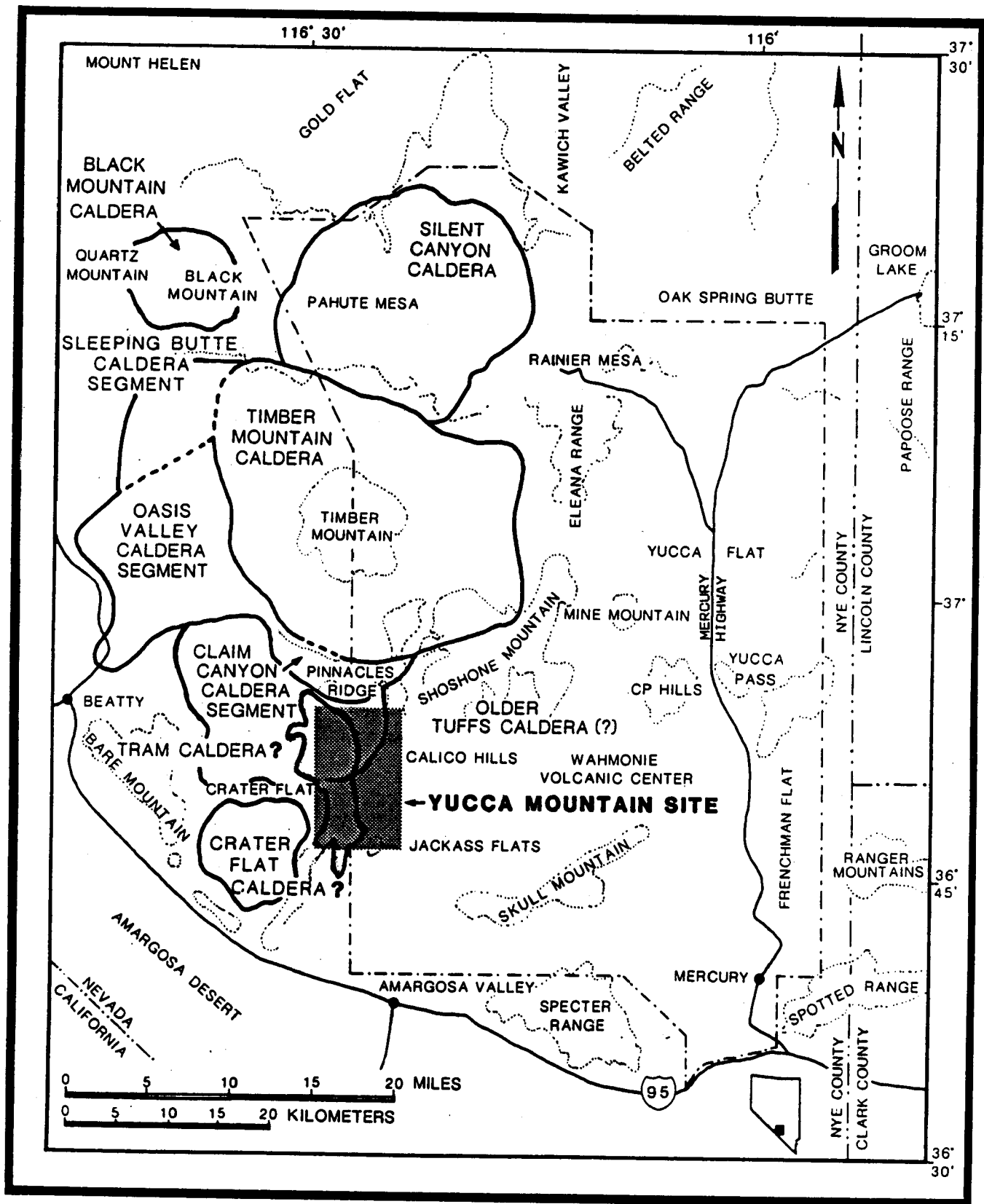


Figure 3-3. Southern end of southern Nevada volcanic field showing possible locations of calderas in the vicinity of Yucca Mountain. Question marks indicate uncertain volcanic centers. Modified from Maldonado and Koether (1983).

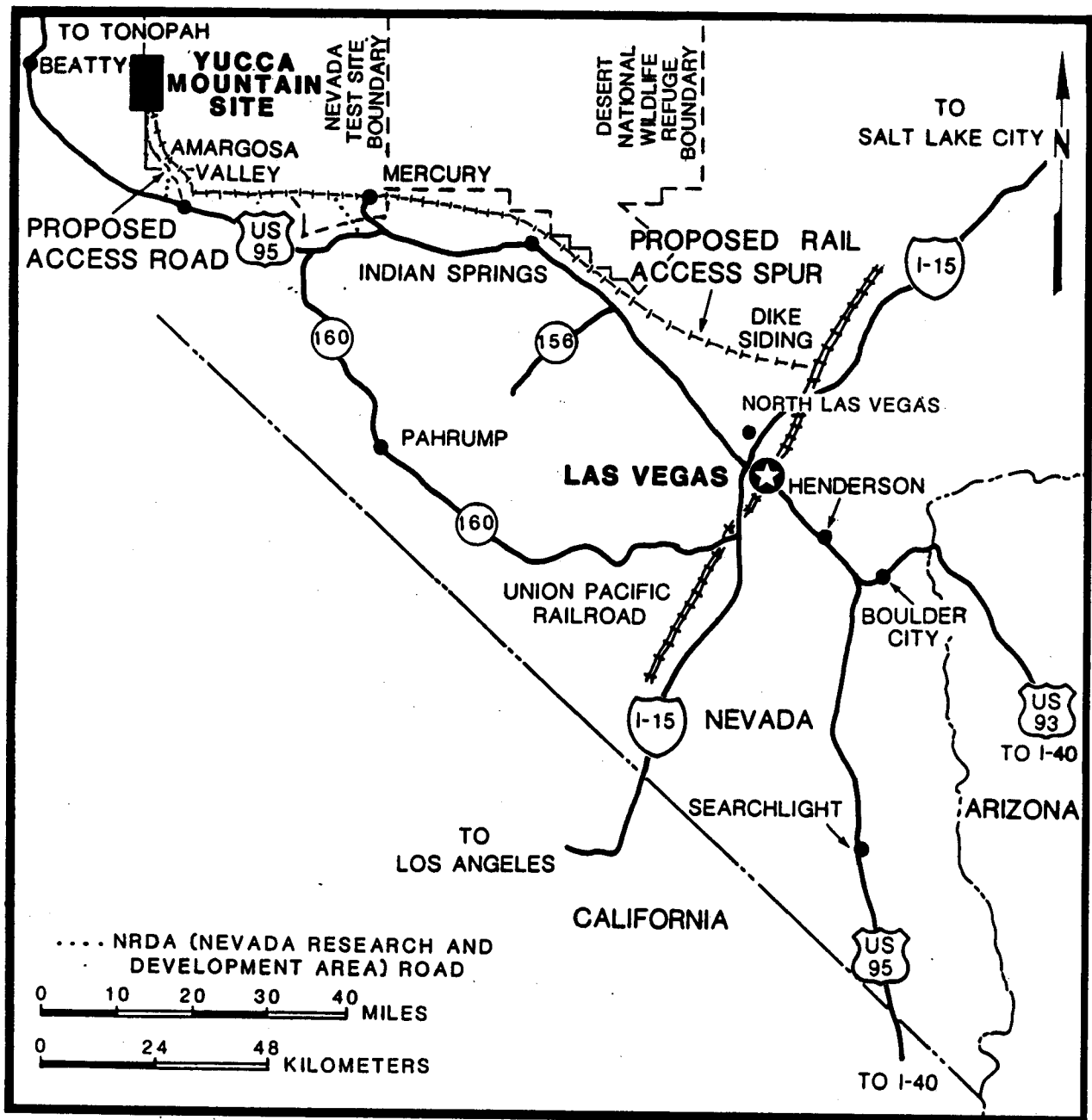


Figure 3-20. Regional transportation network and proposed road and rail access to the Yucca Mountain site.

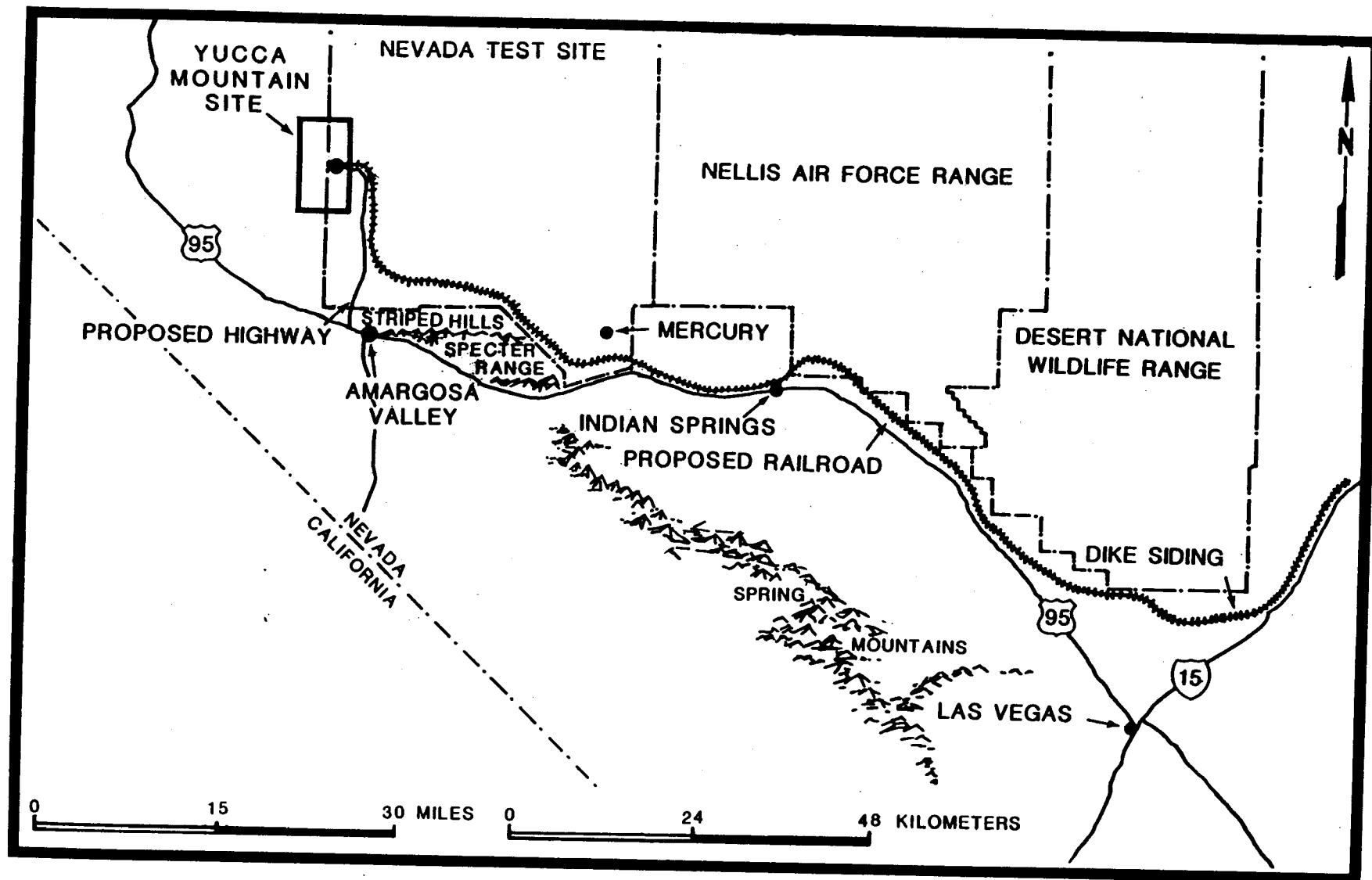


Figure 5-2. Proposed highway and rail access routes to the Yucca Mountain repository.

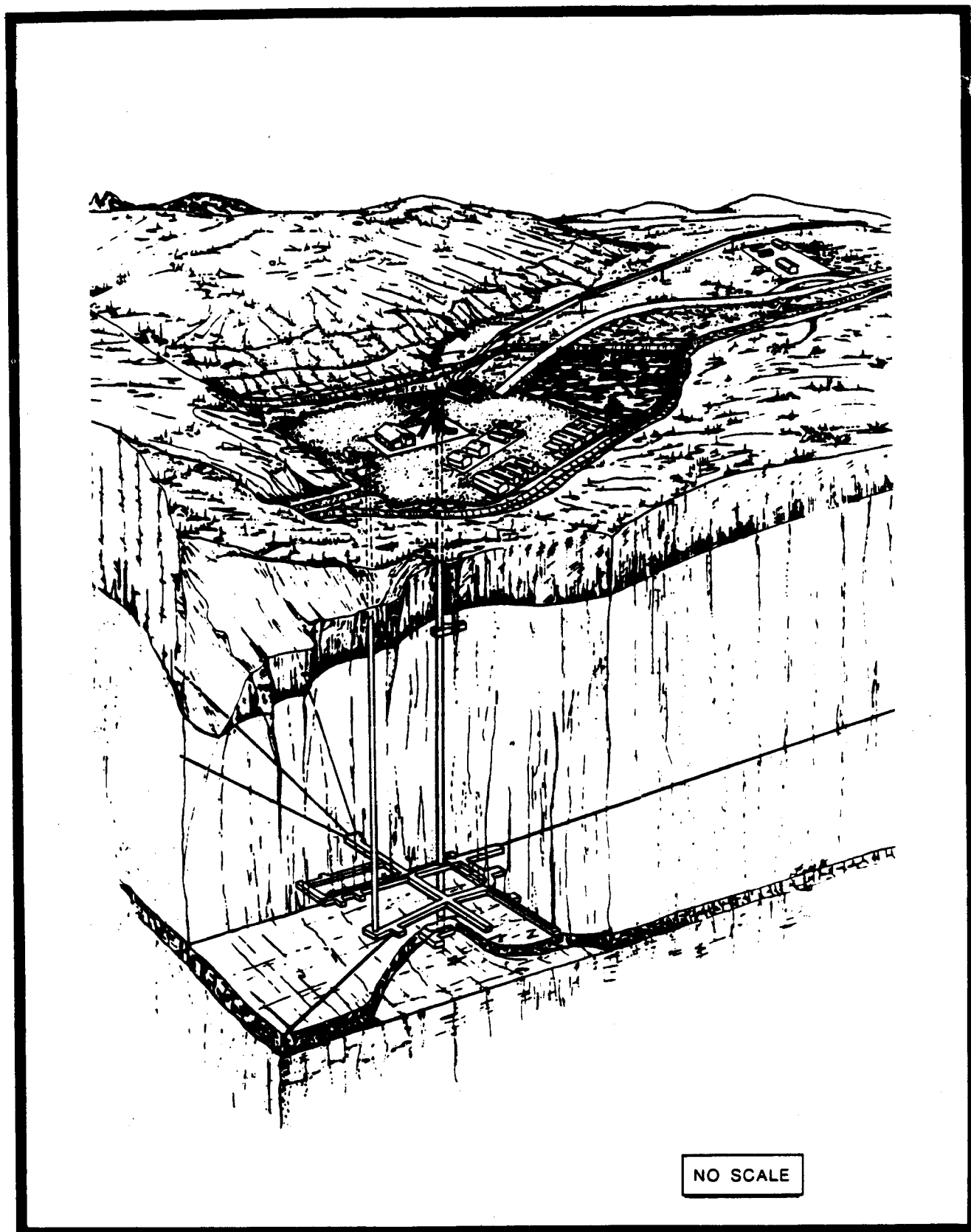


Figure 4-1. Three-dimensional illustration of the exploratory shaft facility.

EXPLORATORY STUDIES FACILITY DESIGN

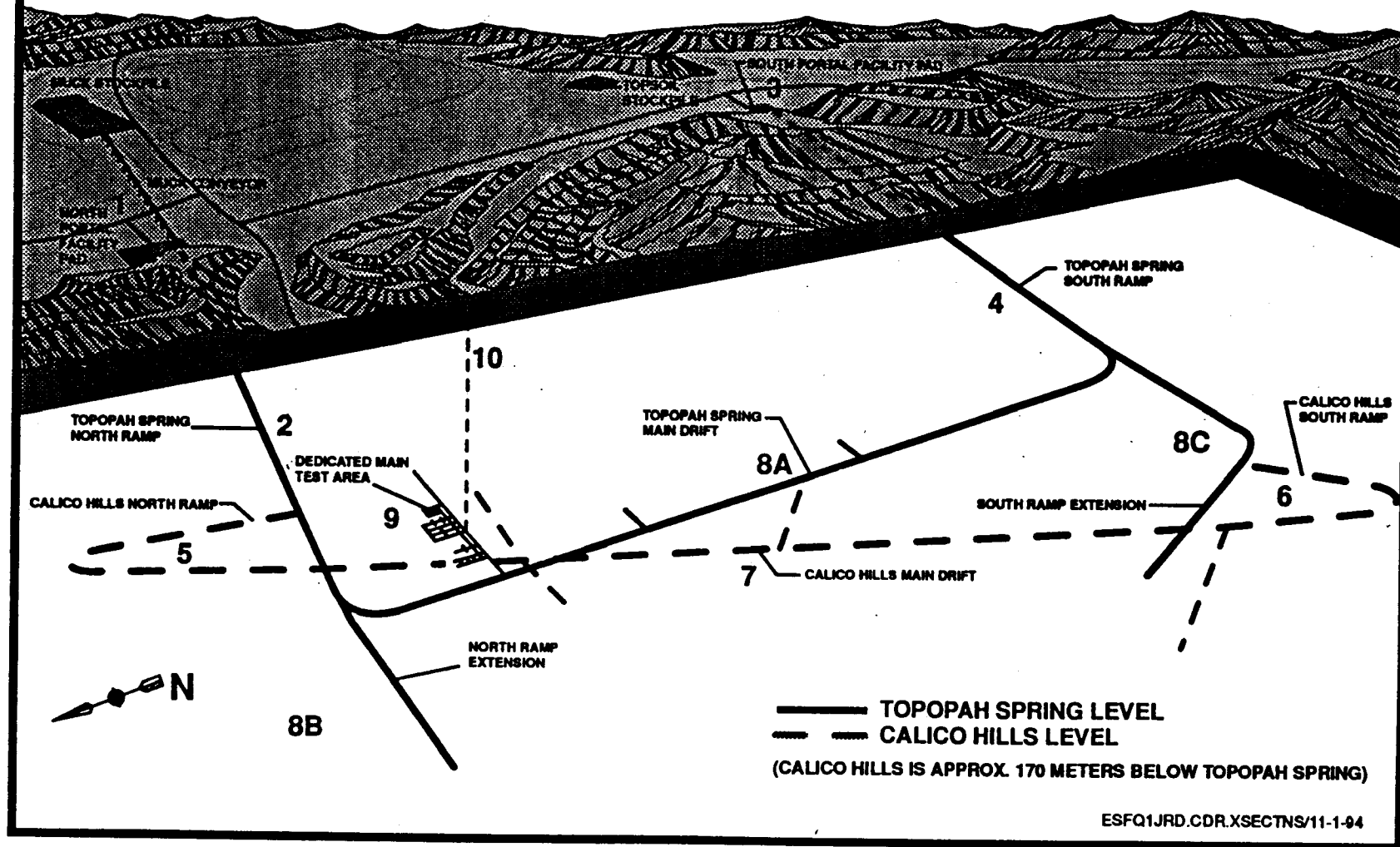


Figure 7-1. Exploratory Studies Facility Design Package Locations