DRAFT COMPREHENSIVE IMPACT ASSESSMENT

Potential impacts to Inyo County, California from the proposed high-level nuclear waste repository at Yucca Mountain, Nevada

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INTRODUCTION

The purpose of this document is to identify and analyze potential impacts to Inyo County, California, from the U.S Department of Energy's proposed high-level nuclear waste repository at Yucca Mountain, Nevada. This document is also intended to provide policy guidance to the Inyo County Board of Supervisors regarding participation in the U.S. Nuclear Regulatory Commission licensing hearings. Yucca Mountain is only 14 miles from the Inyo County line. Inyo County is geographically closer to the repository (with the exception of Nye County) than any other Nevada county. Inyo County will be heavily impacted from the construction and operation of Yucca Mountain, as well as the transportation of nuclear material to the repository. The Inyo County Yucca Mountain Repository Assessment Office prepared this comprehensive impact assessment, with assistance from various contractors employed by the County. This document is the first attempt by the Yucca Mountain Repository Assessment Office to assess all potential impacts to Inyo County from the Yucca Mountain Project. It is anticipated that this comprehensive impact assessment would have to be updated every three to five years. Nothing in this document should be construed as consent or approval to the Yucca Mountain Project by the Inyo County Board of Supervisors, or by the Yucca Mountain Repository Assessment Office.

Brief History of American Nuclear Waste Disposal Policy

The Federal Government's current policy of deep geologic disposal for nuclear material was based on a recommendation given by the National Academy of Science (NAS) in 1957. During the 1950's, the NAS conducted an exhaustive study to determine the best method for permanently disposing of high-level defense waste and spent nuclear fuel. Ideas such as disposal in the ocean floor, polar ice caps, and outer space, were rejected due to risks and uncertainty. The NAS, a highly respected and credible entity in the scientific world, proclaimed deep geologic disposal as the safest and best method of disposal. In 1978, the United States Department of Energy (DOE) began studying Yucca Mountain, Nevada, to determine whether it would be suitable for the nation's first long-term geologic repository for spent nuclear fuel and high-level defense waste.[1]

In 1982, the United States Congress enacted the Nuclear Waste Policy Act (NWPA). This legislation made the DOE responsible for the development of a geologic repository for the safe disposal of the nation's high-level radioactive waste and spent nuclear fuel. It also required the DOE to take title to all spent commercial reactor fuel by 1998.[2]

The DOE then selected nine locations for consideration as potential sites. These sites were studied and the preliminary studies were reported in 1985. Based on these reports, the list was reduced to three potential sites in 1986: Hanford, Washington; Deaf Smith County, Texas; and Yucca Mountain, Nevada.

Congress amended the NWPA in 1987 and directed the DOE to study only Yucca Mountain in Nevada. Congress justified this decision by pointing to preliminary data analysis by the DOE indicating it was the most suitable of the three remaining sites in for deep geologic disposal. Geological disposal in basalt deposits at Hanford was suspect due to the highly fractured state of the rock, and its close proximity to the Columbia River. Salt deposits in Deaf Smith County were eliminated due to questions about its ability to withstand extremely hot temperatures from emplaced waste packages, and also because approximately 18,000 people lived near the proposed repository site. The DOE concluded that the highly dense welded volcanic tuff found at Yucca Mountain would be able to isolate, absorb, and contain escaping radionuclides.

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[1] In 1980, the DOE selected deep geologic disposal as the preferred option for disposal of commercial spent nuclear fuel through the National Environmental Policy Act (NEPA). *See* Final Environmental Impact Statement, Management of Commercially Generated Radioactive Waste (DIRS 104832-DOE).

[2] The NWPA of 1982 originally required that two repositories be built, one in the Eastern United States, and one in the Western United States. *See* Sections 112 and 113 of the Nuclear Waste Policy Act of 1982. This provision was enacted so that the burden of disposing of nuclear waste would be shared between two areas in the United States. This would eliminate a scenario whereby construction, operation, and the accompanying shipping campaign would disproportionately impact one region of the nation. An east coast repository was also meant to simplify the shipping campaign, due to the fact that most of the nation's commercial spent nuclear fuel is in the Eastern and Southeastern United States, regions that heavily rely on nuclear power production. This requirement was eliminated with the passage of the 1987 amendments to the NWPA, which directed the DOE to study only Yucca Mountain.

Other reasons given by Congress for its designation were the arid climate of southern Nevada, its remote location, and the abundance of federal lands surrounding the repository. Additionally, the area surrounding Yucca Mountain had already been subjected to intense radioactive exposure from atmospheric and underground testing of nuclear weapons at the Nevada Test Site. However, many critics contend the decision was based on political, rather than scientific factors, due mainly to weak representation in Congress by Nevada's federal lawmakers at the time.

In 2002, Secretary of Energy Spencer Abraham forwarded his site characterization recommendation of approval to the Bush Administration.[3] This would allow the DOE to submit its license application for construction authorization to the U.S. Nuclear Regulatory Commission (NRC). Under federal law, the NRC reviews every aspect of the Yucca Mountain Project (YMP), to include evaluation of all scientific work and system performance. The formal NRC licensing process will involve external experts in the technical review that will occur when the NRC considers issuing licenses to construct and operate a repository. Under the NWPA, the licensing process can last three to four years. If the DOE is ever granted construction authorization from the NRC, it will still have to participate in another formal adjudicatory proceeding to receive and store nuclear material at Yucca Mountain.

Pursuant to the NWPA, the governor of Nevada was allowed to veto the site characterization recommendation, which Governor Kenny Guinn did later that year. However, the NWPA also gave the power to Congress to override the veto of the Governor.[4] Over Governor Guinn's veto, in July 2002 Congress approved, and President Bush signed the Yucca Mountain Development Act (Public Law 107-200). This law allowed the DOE to submitt a license application to the NRC for construction authorization of a geologic repository at Yucca Mountain. The NWPA states that the license application must be submitted no later than 90 days after Congressional approval.[5] The original deadline was missed in 2002, and a subsequent deadline was also missed in 2004. Currently, the DOE is still in the process of preparing its license application for submittal to the NRC.

The DOE has stated the license application will be submitted no later than June 30, 2008. The DOE estimates the best achievable date for opening the repository is 2017. Litigation is expected no matter what the NRC decides in relation to the YMP, so the DOE has also stated that a more likely date, should construction authorization be granted, is 2021. The Yucca Mountain Repository Assessment Office (RAO) believes that 2025-2030 is a better estimate given the numerous safety concerns with the repository, the potential for the NRC licensing proceedings to take longer than the three to four years the NWPA currently allows, the enormous cost and difficulty of rail line and repository construction, potential litigation, and extreme opposition by the State of Nevada and its citizens. These

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[3] U.S. Department of Energy, Recommendation by Secretary of Energy Spencer Abraham regarding suitability of the Yucca Mountain Site for a Repository under the Nuclear Waste Policy Act of 1982, February 2002.

[4] Section 115, Nuclear Waste Policy Act of 1982.

[5] Section 114 (b), Nuclear Waste Policy Act of 1982.

factors may also prevent the repository from ever opening, and force the Federal Government to amend the NWPA, which mandates nuclear waste be permanently disposed of at Yucca Mountain, or change its current policy of geologic disposal of nuclear waste.

History of Inyo County Oversight Activities in Relation to the Yucca Mountain Project

The NWPA provides annual funding to the State of Nevada and local governments to assess the validity and accuracy of the YMP's scientific methods and results. Specifically, the language of Section 116 (c) authorizes the Secretary of Energy to "make grants to the State of Nevada and any affected unit of local government for purposes of enabling such State or affected unit of local government to:

(i) To review activities taken under this subtitle with respect to the Yucca Mountain site for purposes of determining any potential economic, social, public health and safety, and environmental impacts of a repository on such State, or affected unit of local government and its residents;
(ii) To develop a request for impact assistance;
(iii) To engage in any monitoring, testing, or evaluation activities with respect to site characterization programs with regard to such site;
(iv) To provide information to Nevada residents regarding any activities of such State, the Secretary, or the Commission with respect to such site; and
(v) To request information from, and make comments and recommendations to, the Secretary regarding any activities taken under this subtitle with respect to such site."[6]

Currently, under Section 116 (c), the State of Nevada, nine Nevada counties, and Inyo County receive annual appropriations to conduct oversight of the DOE in regards to the YMP.

Inyo County is considered an "Affected Unit of Local Government" (AULG) under the NWPA. In order to be designated an AULG, a county must share a common border with Nye County, Nevada, the situs county for Yucca Mountain. In 1987, under Resolution #88-69, the Inyo County Board of Supervisors took action in declaring its support to be declared an AULG under the NWPA. The Board adopted the resolution due to potential impacts relating to groundwater resources in Southeast Inyo County and to the potential shipments of radioactive waste through the County.

Inyo County then formally petitioned the Secretary of the DOE for designation as an AULG under the NWPA.[7] The DOE denied the County's request based on two factors. First, the DOE believed that natural barriers in the mountain were sufficient to prevent

[6] Section 116 (c), Nuclear Waste Policy Act of 1982. In addition, Section 118 (b) provides funding for affected Indian tribes.
[7] Letter from Roger Dehart, Inyo County Planning Director, to Secretary of Energy John Herrington, August 3, 1998.

radionuclide transport via groundwater to Inyo County. Second, the DOE stated that transportation routes had not been established and that impacts from transportation alone would not enable the County to obtain AULG status.[8]

Inyo County then looked to the State of California to assist it in obtaining AULG status. Governor George Deukmejian and U.S. Senator Pete Wilson wrote letters to the Secretary of DOE asking him to reconsider his decision to not grant Inyo County AULG status in light of the concerns voiced by the Inyo County Board of Supervisors.[9] The Secretary again refused these requests.

In 1990, Inyo County brought formal legal action against the DOE in the United States Court of Appeals for the Ninth Circuit. The County argued that the Secretary's decision to not designate the County as an AULG was arbitrary and capricious because of potential groundwater and transportation impacts. The Court rendered its decision in 1991, vacating the Secretary's previous decision.[10] Later that year, Inyo County was formally designated an AULG under the NWPA. Inyo County is the only California County to receive such a designation.

From 1991 through 2007, Inyo County has received $5,760,527 under Section 116 (c) of the NWPA to participate in oversight activities of the DOE and the YMP. The County has also been awarded $6,411,064 from Cooperative Agreements with the DOE since March 2002 for hydrological studies, which provides funding for drilling and groundwater monitoring programs.

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[8] Letter from Charles Kay, Director, Office of Civilian Radioactive Waste Management, to Roger Dehart, Inyo County Planning Director, October 7, 1988.

[9] Letter from George Deukmejian, Governor, State of California, to Secretary of Energy James Watkins, January 23, 1989, and letter from United States Senator Pete Wilson, to Secretary of Energy James Watkins, January 23, 1989.

[10] 925 F.2d 1216 (1991).

GROUNDWATER IMPACTS

The proposed high-level nuclear waste repository at Yucca Mountain, Nevada will likely impact groundwater resources in Southeast Inyo County. The questions of when impacts will be detected, and the severity of such impacts, remain a subject of debate between Inyo County and the DOE. A primary factor in the Ninth Circuit Court of Appeals' designation of Inyo County as an AULG was potential impacts to groundwater in Southeast Inyo County, to include the communities of Death Valley Junction, Shoshone, Tecopa, and Death Valley National Park (DVNP).[11] The County has conducted numerous scientific groundwater evaluations since 1996. The three major findings of this research are:

1. There is significant evidence, through geophysical surveying, geochemical sampling and analysis, and groundwater modeling, that the Lower Carbonate Aquifer, which underlies the repository site, has discharge points on the west side of the Funeral Mountains in and around Furnace Creek in Death Valley National Park.

2. The upper gradient found in the Lower Carbonate Aquifer, the tendency of the water to move upward because of hydraulic head, may act as a barrier to radionuclide transport from the repository.

3. Current and future groundwater pumping in the region could affect the upper gradient, as well as the migration of radionuclides from the repository.

In its 2002 Final Environmental Impact Statement for Yucca Mountain, the DOE also found that water from the shallower volcanic tuff aquifers surfaces in the area around Alkali Flat and Franklin Lake Playa, east of Death Valley Junction.[12] However, the DOE does not state where the water may go from here.

This section describes the County's groundwater studies program since 1996, potential impacts from the repository, and unresolved issues that the County believes the DOE needs to address in both its National Environmental Policy Act (NEPA) analysis and its License Application (LA) submission to the U.S. Nuclear Regulatory Commission. In the DOE's 2002 Final Environmental Impact Statement for Yucca Mountain, it estimated that 74,000 people may be exposed to groundwater contaminated by radionuclides from the repository.[13]

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[11] 925 F.2d 1216, 1220-21 (1991).

[12] Chapter 3, pages 3-41, 3-45, 3-64, Affected Environment, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

[13] Chapter 3, pages 5-24 and 5-25, Environmental Consequences of a Long-Term Repository Performance, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-

Impacts to the Lower Carbonate Aquifer

The Lower Carbonate Aquifer (LCA) underlies most of Nevada, as well as parts of Utah and the Death Valley region in California. The LCA has been found at depths between 2500 and 5000 feet. The LCA is a Paleozoic aquifer, which contains mostly ancient water with little recharge. Beginning in 1996, The Hydrodynamics Group, on behalf of the County, conducted numerous scientific studies on behalf of the County to determine the possible connection of the LCA, which underlies Yucca Mountain, to the springs on the west side of the Funeral Mountains near Furnace Creek in DVNP.

These studies have determined that it is very likely a continuous layer of saturated carbonate rock exists through a highly fractured and faulted section of the Southern Funeral Mountains.[14] This allows the aquifer to mix with surface springs through two major spillways in the Funerals, and come to the surface via Texas, Travertine, and Nevares Springs in the Furnace Creek area.[15] The LCA is also believed to have flow paths south of the repository through the Amargosa Valley, Ash Meadows National Wildlife Refuge, and in to California near Death Valley Junction.[16]

Geochemical Analysis

Extensive geochemical sampling and analysis has been conducted on many springs in DVNP to ascertain whether the LCA has discharge points on the west side of the Funeral Mountains. The LCA has a distinct chemical composition, which includes major traces of calcium and magnesium.[17] This allows for improved reliability in the tracking of flow paths of the LCA. Texas Springs, Travertine Springs, and Nevares Springs, all located near Furnace Creek, are believed to be recharged by the LCA.[18] This is especially important given that Nevares Springs is the main water supply for Cow Creek, which provides housing for National Park Service employees. Travertine Springs provides water for the Park Headquarters and Museum, Furnace Creek campgrounds, the Furnace Creek Ranch and Inn, and the Timbisha Shoshone Tribe.

Geophysical Surveying and Groundwater Modeling

The Hydrodynamics Group has also performed extensive geophysical surveying in the Ash Meadows area and the Southern Funeral Mountains in order to predict potential flow paths and the depth of the LCA.[19] Geophysical surveying, rather than drilling, is the best

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EIS-0250) 2002. The DOE estimated that individuals exposed to radionuclides from the repository will be mainly from the State of California, 19-37 miles downgradient from Yucca Mountain. *Id.*

[14] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 78. For a summary of County groundwater studies between 2002-2005, see Death Valley Lower Carbonate Aquifer Monitoring Program, U.S. Department of Energy Cooperative Agreement DE-FC08-02RW12162, Final Project Report, 2002-2005, *available at* http://www.inyoyucca.org/lsn.html.

[15] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 68.

[16] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, pages 56-76.

[17] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, pages 56-76.

[18] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 69.

[19] *See generally*, Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program.

method to analyze the LCA in many locations in and around the Funeral Mountains because ideal drilling locations are in either Federally designated wilderness within DVNP where drilling is not allowed, or regions which are geographically rugged and remote to be accessed by a drill rig.

From geophysical surveying, and previous models constructed by the U.S. Geographical Survey, two new groundwater models were formulated to predict migration paths of the LCA from Yucca Mountain to DVNP. The first model detailed the area south from the repository through the Amargosa Valley and to the Southern Funeral Mountains, and the second analyzed the area from the Southern Funerals into DVNP. These models indicate that the LCA does flow southwest from the repository through the Funerals and Furnace Creek fault, discharging from Nevares, Texas, and Travertine Springs.[20] Modeling using geophysical surveying in the Amargosa Valley, and around Devil's Hole in DVNP in Nevada, also indicates the LCA flows south from the repository through Ash Meadows and the Devil's Hole area in to California east of Death Valley Junction.[21]

The DOE has stated that it does not consider risks to the LCA possible because of the extreme depth of the groundwater.[22] Due to this assumption, the DOE's analysis of flow pathways and groundwater migration times of the LCA have been limited. There has not been any substantive analysis by the DOE to predict radionuclide migration times in to the LCA. The DOE drilled one borehole, UE 25-P1, that penetrated the LCA at the repository site.[23] Geochemical analysis of carbonate water from this borehole suggests that it flows slower than other water within the carbonate rock flow system of the LCA.[24]

However, geochemical analysis from one borehole at the repository site is insufficient when studying an aquifer that is as deep and large as the LCA. The area between the repository and the LCA is highly fractured with numerous active faults running near the repository boundary.[25] One major seismic event could create barriers to flow or new fast pathways to the LCA. Finally, it would be impossible to mitigate impacts to the LCA.[26] This is due to the estimated fast travel times of the groundwater, as a result of the sharp down gradient in the Amargosa Valley. This virtually ensures that once radionuclides enter the LCA, they will travel down gradient to points in Inyo County.

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[20] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 36.
[21] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, pages 42-55.
[22] Chapter 3, pages 3-39-49, Affected Environment, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.
[23] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 83.
[24] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 83.
[25] Mike King, The Hydrodynamics Group, Devil's Hole Presentation, May 3, 2007, & Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 10.
[26] Mike King, The Hydrodynamics Group, Devil's Hole Presentation, May 3, 2007.

Impacts to Volcanic Tuff Aquifer Resources

The repository will also highly impact shallower groundwater resources in the region. These aquifers, which are found at depths of 1000-2000 feet in the volcanic tuff of the region, were formed in the Tertiary period. The Saturated Zone at Yucca Mountain is the closest groundwater resource to the repository, and therefore, the groundwater that will be contaminated first with radionuclides from waste packages. The Saturated Zone is one of multiple volcanic tuff aquifers found in the region. Numerous studies conducted by the DOE and Nye County found that radionuclides would leave the repository via groundwater in a generally southeast direction, towards Forty Mile Wash, eventually migrating into the Amargosa River drainage.[27] In its 2002 Final Environmental Impact Statement for Yucca Mountain, the DOE found that water from volcanic aquifers beneath Yucca Mountain surfaces in the area around Alkali Flat and Franklin Lake Playa, east of Death Valley Junction.[28] Migrating groundwater and surface water in the Amargosa River drainage reaches its terminus at Badwater Basin in DVNP.[29] The level of connectivity between the LCA and volcanic aquifers remains in question, but it is an established hydrologic principle that groundwater is closely connected to surface water. It is very likely that there is a high level of connectivity between volcanic aquifers and surface water in the region.[30]

Nye County has drilled a series of wells, called the Early Warning Drilling Program (EWDP).[31] These wells will be used to monitor whether radionuclies are contaminating the Saturated Zone and migrating off site. It is unclear whether any of the boreholes penetrated the Lower Carbonate Aquifer. Presently, the only compliance point is near Gate 5-10 of the Nevada Test Site. This point will measures radiation does of escaping radionuclides from the repository. A compliance point somewhere in Inyo County may be a good, if redundant, option for monitoring groundwater. An Inyo compliance point may be viewed as another tool for detecting water contaminated with radionulides within the County as early as possible. Pump out wells for extracting contaminated water may be effective in limiting the extent of damage to volcanic groundwater resources, but would consume massive amounts of energy and have a detrimental effect on plants, wildlife, the desert ecosystem, and the tranquility and aesthetics of the region.

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[27] Scott James, Sandia National Laboratories, Devil's Hole Presentation, May 2, 2007, & Chapter 3, pages 3-41, 3-45, 3-64, Affected Environment, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

[28] Chapter 3, pages 3-41, 3-45, 3-64, Affected Environment, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

[29] The elevation of the Saturated Zone at the repository site is approximately 3000 feet, and the potential terminus for volcanic aquifers is in Badwater Basin, 282 feet below sea level. Badwater Basin is the terminus for all surface water in the Amargosa River drainage as well.

[30] Recent studies have also indicated that more water may be moving south from Yucca Mountain through volcanic tuff formations than previously thought, and that the velocity of that water is faster than previously considered. Barry Freifeld, Lawrence Berkeley National Laboratories, U.S. Department of Energy, Devil's Hole Presentation, May 3, 2007.

[31] *See* http://www.nyecounty.com/ewdpmain.htm.

The Upper Gradient as a Barrier to Radionuclide Migration

Hydraulic head measurements of LCA boreholes indicate that there is a strong upper gradient present in the aquifer.[32] This upper gradient is not constant throughout the LCA and could vary based on sampling location. The upper gradient is caused by decreases in elevation along the flow path of the LCA, forcing carbonate water to move upward within the confined space of the aquifer. The upper gradient has the potential to move groundwater upward from the carbonate in to the overlying volcanic tuff. When radionuclides migrate off-site from the repository, it is believed that the upper gradient will initially act as a barrier to radionuclide transport within the LCA.[33] As long as the conditions remains as presently observed, the LCA is protected from contamination moving downward from the repository. This is especially important given the estimated velocity of the water in the LCA in deeper portions of the aquifer. If radionuclides enter the deeper portions of the LCA, estimated travel times from the repository site to springs in DVNP range from 50-500 years.[34]

Impacts from Current and Future Groundwater Pumping

The upper gradient has the potential to be impacted from current or future regional pumping of groundwater.[35] This will substantially affect the potential for radionuclides to migrate from the repository. Current and future pumping may also affect properties of the LCA.[36]

The DOE does not consider impacts from pumping, both current and future, because they are considered too speculative to accurately predict future impacts.[37] By engaging in limited analysis of the effects of groundwater pumping on the LCA and shallower volcanic aquifers, the DOE ignores the reality that the groundwater basin is currently over allocated, and may be further stressed from water demands of Las Vegas and Clark County. The Southern Nevada Water Authority (SNWA) has recently been granted access to 60,000 acre feet from the LCA in Spring Valley, near Great Basin National Park in eastern Nevada, to transport to the Las Vegas area for residential development.[38] This figure may be increased to 90,000 acre feet if the SWNA can prove that water extraction from the LCA is not negatively impacting the environment. While this pumping will take place at least 200 miles up gradient from the repository, it its unknown

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[32] *The Lower Carbonate Aquifer as a Barrier to Radionuclide Transport*, The Hydrodynamics Group, 2005.
[33] *The Lower Carbonate Aquifer as a Barrier to Radionuclide Transport*, The Hydrodynamics Group, 2005.
[34] Mike King and John Bredehoeft, The Hydrodynamics Group, Devil's Hole Presentation, May 3, 2007.
[35] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 4.
[36] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 4.
[37] National Academy of Sciences, *Technical Bases for Yucca Mountain Standards*, pages 120-124, National Academy Press, 1995.
[38] *See* http://www.snwa.com/html/wr_gdp.html.

whether massive pumping of the LCA in other portions of Nevada has the possibility to affect flow paths, gradients, and properties of the LCA.

Waste Package Corrosion and Radionuclide Migration

Groundwater will be the most likely medium to transport radionuclides from the repository site to the biosphere.[39] The two most important uncertainties that the DOE has yet to fully resolve in its analysis of radionuclide migration are water infiltration rates into the mountain and waste packaging corrosion rates.[40] Modeling is used to predict these two factors 10,000 years, and perhaps as far as 1,000,000 years, in to the future. The final U.S. Environmental Protection Agency rule regarding acceptable radiation dose rates at the compliance point, located near Nevada Test Site Gate 5-10, has not yet been finalized.[41] It should be noted that this is the only compliance point for the entire repository. The compliance point also appears to have been selected because it is at the far southern boundary of the Nevada Test Site, rather than for any unique radionuclide detection capabilities. Inyo County supports a 1,000,000-year compliance period for radiation dose standards.[42] Inyo County remains concerned that no scientific consensus exists regarding repository operation and safety, water infiltration rates, and waste package corrosion rates.

Originally, the DOE wanted to rely primarily on the geologic features of the site to isolate and contain radionuclides. However, a complex and robust waste package system was conceived in response to the hydrologic and geologic conditions discovered at Yucca Mountain. The DOE is now relying primarily on engineered barriers to contain and isolate radionuclides within the repository. The waste package will consist of an inner stainless-steel package, a nickel alloy outer covering, and a titanium "drip shield" to prevent corrosion. If the DOE believes that geologic features will play a very small role in containing radioactivity from waste packages, the site ceases to be effective or distinctive for deep geologic disposal. The DOE may be better served by studying other sites where the geologic features can be more adequately utilized to contain escaping radionuclides.

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[39] Mike King and John Bredehoeft, The Hydrodynamics Group, Devil's Hole Presentation, May 3, 2007.

[40] Steve Frishman, State of Nevada Agency for Nuclear Projects, presentation to California Energy Commission, June 4, 2007, Sacramento, California.

[41] In *State of Nevada vs. U.S. Environmental Protection Agency*, 373 F.3d 1251 (2004), the EPA's final rule on acceptable dose releases was invalidated by the District of Columbia Circuit Court of Appeals. The rule used only a 10,000-year compliance period. The court ruled that the EPA also did not follow the National Academy of Science's recommendation that the EPA use the mean peak dose (instead of the median peak dose, which the EPA used) in formulating the rule.

[42] The old EPA rule allowed a dose of 15 milirems to a person standing at the compliance point, near Gate 5-10 of the Nevada Test Site. The rem is a unit used to derive a quantity called "equivalent dose." This relates the absorbed dose in human tissue to the effective biological damage of the radiation. Not all radiation has the same biological effect, even for the same amount of absorbed dose. Equivalent dose is often expressed in terms of thousandths of a rem, or milirem. To determine equivalent dose (rem), you multiply absorbed dose (rad) by a quality factor (Q) that is unique to the type of incident radiation. http://www.physics.isu.edu/radinf/terms.htm.

Another factor that will affect radionuclide transport is the current design of a "cool" repository. During the 1990's, the DOE had two different configurations for Yucca Mountain. One planned to have waste packages closer together, which would generate tremendous heat output from the radioactive material it contained. While this would boil off any groundwater in proximity to the waste package, and require less space for the entire repository, it also has drawbacks. The effects of the tremendous heat was believed to lead to faster corrosion rates for the waste packages, and may also have unforeseen effects on the volcanic tuff, causing it to erode quicker than previously modeled. This was the "hot" design.[43]

The "cool" design now preferred by the DOE spaces waste packages farther apart, causing waste packages to remain robust for longer periods of time because of the lower temperatures in the repository drifts. However, this scenario would require that more earth be excavated for the repository, and would not result in drift temperatures above boiling. This would allow groundwater to seep around the waste packages, and impact corrosion rates.[44] Compounding the problem in modeling waste package corrosion is the fact that groundwater in Yucca Mountain is known to be highly corrosive due its salt content and the presence of fluoride.[45] This highly corrosive water may increase "localized corrosion", the non-uniform pitting of metal surfaces.[46]

Impacts to Surface Water

Surface water, in addition to numerous tuff aquifers in the region, is known to move from the repository site to Forty Mile Wash east of the site, and into the Amargosa River drainage. The DOE also acknowledges that shallower aquifers follow this same flow path in to the Amargosa River drainage, and comes to the surface at Alkali Flat and Franklin Lake Playa, east of the community of Death Valley Junction.[47] The terminus of the flow paths for surface water in the Amargosa River drainage is Badwater Basin in DVNP. In the 2002 Final Environmental Impact Statement for Yucca Mountain, the DOE states that 69,500 people could be exposed to contaminated groundwater at Franklin Lake Playa during the next 10,000 years.[48]

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[43] McFarland, Allison and Ewing, Rodney, *Uncertainty Underground*, MIT Press, 2006, pages 17-22 & 292-95.

[44] McFarland, Allison and Ewing, Rodney, *Uncertainty Underground*, MIT Press, 2006, pages 17-22 & 292-95.

[45] McFarland, Allison and Ewing, Rodney, *Uncertainty Underground*, MIT Press, 2006, pages 181& 307.

[46] McFarland, Allison and Ewing, Rodney, *Uncertainty Underground*, MIT Press, 2006, pages 290-98.

[47] Chapter 3, pages 3-41, 3-45, 3-64, Affected Environment, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

[48] Chapter 5, pages 5-24-25, Environmental Consequences of Long-Term Repository Performance, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002. The DOE estimates that 74,000 total people will be exposed to contaminated groundwater from pints north of Franklin Lake Playa during the next 10,000 years.

While surface water is not expected to be impacted by repository operations within the mountain, numerous surface facilities that temporarily store and package waste will be present at the site. The DOE needs to conduct specific analysis of impacts to these facilities in the case of a flood event, as any hazardous material or radioactive waste on the surface carried off by floodwaters would enter the Amargosa River drainage.

Wild and Scenic River Designation of the Amargosa River

The Inyo County Board of Supervisors voted to support the designation of the Amargosa River as a "Wild and Scenic River" under the Wild and Scenic Rivers Act.[49] This designation would be 23 miles in length, from Shoshone south to the Dumont Dunes in San Bernardino County. Currently, it is unknown when Congress will officially vote on the designation. The Wild and Scenic Rivers Act is notable for safeguarding the special character of these rivers, while also recognizing the potential for appropriate use and development. Designated rivers are uniquely managed to protect the public's enjoyment of these heritage resources for present and future generations. The managing agencies also try to accommodate and reflect community and landowner interests.

The Act strives to balance river development with permanent protection for the country's most outstanding free-flowing rivers. The Act prohibits federal support of dam construction, federally assisted water resources projects, or other instream activities, that would diminish the river's free flow or outstanding resource values. The Act protects outstanding natural, cultural, or recreational values, ensures water quality is maintained, and requires the creation of a comprehensive river management plan that addresses resource protection, development of lands and facilities, and user capacities. If the Amargosa River is given federally protected status, any release of radionuclides from the repository into the protected area of the river would be a violation of the Wild and Scenic River Act, as well as other applicable federal and state environmental laws.

Impacts to the Timbisha Shoshone Tribe

In June 2007, the Timbisha Shoshone Tribe was given affected status under the NWPA.[50] Groundwater impacts on tribal lands were a primary justification for the Department of the Interior to designate the tribe under Section 118 (b) of the NWPA as an "Affected Indian Tribe." The Tribe is still in the process of obtaining funding and organizing an oversight program. Potential contamination of volcanic tuff aquifers, the main supply of drinking water for tribal lands located in Inyo County, would be a serious impact to the Timbisha Shoshones from the YMP.

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[49] Inyo County Board of Supervisors Resolution # 2004-51.

[50] Letter from Carl Artman, U.S. Department of Interior, to Joe Kennedy, Chairman, Timbisha Shoshone Tribe, dated June 29, 2007.

Conclusion

Currently, there is vigorous debate within the scientific community on the safety and future performance of the repository.[51] Many uncertainties remain regarding waste package corrosion[52], water infiltration[53] and migration, and the geologic stability of the site.

Analysis to date performed by the DOE regarding potential groundwater impacts to Southeast Inyo County is inadequate. The 2002 FEIS is the best source for Inyo County and the public to assess the DOE's methodology in analyzing groundwater impacts. The DOE has acknowledged that groundwater from tuff aquifers under the repository comes to the surface at Franklin Lake Playa and Alkali Flat, near Death Valley Junction. However, the DOE does not state where the water may go from here, either above or belowground, and the DOE has not offered any plan for remediation of contaminated sites in California.

The DOE also has conducted limited analysis of impacts to the LCA. The DOE's justification has been that the LCA is too deep for contamination by radionuclides. The DOE has drilled only one carbonate borehole at the site, which is viewed as inadequate because of the size of the LCA, and the velocity at which groundwater is believed to flow.[54] Missing completely from the DOE's analysis is the relationship between water infiltration times, waste package corrosion rates, and their impacts on groundwater in Inyo County. Studies conducted by Inyo County indicate spring water from discharge points in the Furnace Creek area are most likely recharged from groundwater underneath of Yucca Mountain.[55] If radionuclides are transported to DVNP through a continuous

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[51] Only one compliance point exists for the radiation dose standard for the entire repository, near Gate 5-10 of the Nevada Test Site. The U.S. Environmental Protection Agency (EPA) still has not released the final rule regarding acceptable releases of radiation from the repository. The State of Nevada sued the EPA and prevailed over the adequacy of the last dose standard, which used a 10,000-year compliance period. Whatever the final dose standard promulgated by the EPA is, the DOE would also have to comply with the Clean Water Act, the Safe Water Drinking Act, and the Comprehensive Environmental Clean-Up and Liability Act for operation of the repository.

[52] By the DOE's own admission, an overwhelming majority of radioactive waste containment and isolation at the site comes from man-made engineered barriers. This implies the site is not distinctive of unique when isolating radionuclides, or preventing radionuclide migration off-site. Shoesmith, David, *Uncertainty Underground*, MIT Press, 2006, page 287, and *Status of Yucca Mountain Nuclear Waste Repository*, Victor Gilinsky, Stanford University, March 7, 2006, *available at* http://www.state.nv.us/nucwaste/news2006/pdf/stanford060307gilinsky.pdf.

[53] The State of Nevada contends that the site should have been disqualified in the early 1990's under the DOE's own criteria for water infiltration and migration within the mountain. The DOE prevented the site from being disqualified for geologic disposal by later revising these standards for groundwater movement at the site. See 10 CFR 960 and 10 CFR 963, Federal Register, November 14, 2001 & *Status of Yucca Mountain Nuclear Waste Repository,* Victor Gilinsky, Stanford University, March 7, 2006, *available at* http://www.state.nv.us/nucwaste/news2006/pdf/stanford060307gilinsky.pdf.

[54] Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 94.

[55] Spring water in the Furnace Creek area may also be recharged from Amargosa Valley alluvium, or from springs around Ash Meadows National Wildlife Refuge. Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 84. Recharge to Ash Meadows National Wildlife Refuge comes mainly from the north side of the Spring Mountains, Year One Project Report, Death Valley Lower Carbonate Aquifer Monitoring Program, page 81.

hydrological connection with the LCA, or shallower groundwater resources are contaminated by radionuclide migration off-site from the repository, it will severely impact the residents, environment, plants and wildlife, and economy of Inyo County.

IMPACTS FROM TRANSPORTATION

This section examines the DOE's National Transportation Plan (NTP) to the repository, limitations of the NTP, and potential impacts to Inyo County. Inyo County will be heavily impacted by any shipping campaign of nuclear material to Yucca Mountain due to the proximity of the County to the site.

The DOE has stated that the proposed Caliente Rail Corridor is the preferred method of shipping nuclear material to the repository, but has yet to designate any truck routes to the repository. Such designations are not expected until 2009 at the earliest. The NTP was published in draft form in the summer of 2007. The DOE then ordered that the NTP be taken out of circulation for more revisions. It is currently unknown when the NTP will be reissued for comment. The California Highway Patrol, the California Department of Transportation, the California Energy Commission, the Inyo County Board of Supervisors, and the Yucca Mountain Repository Assessment Office believe that the County's highways are presently inadequate for shipping campaigns of spent nuclear fuel and high-level defense waste to Yucca Mountain.[56]

[56] For current locations of radioactive waste in the United States, go to http://www.ocrwm.doe.gov/info_library/newsroom/photos/photos_natlmap.shtml

Caliente Rail Corridor

Shipping by rail is the DOE's preferred method of transporting nuclear material to the repository. The Caliente Rail Corridor through Lincoln and Nye Counties in Nevada is the DOE's preferred rail route for transporting nuclear material to the Yucca Mountain. While the Caliente route does not traverse any part of Inyo County, the County can expect impacts during a portion of rail line construction. Construction materials, equipment, and personnel will likely be transported on California Highways 127, 178 or 190 during construction of the Caliente rail route which begins near Tonopah, Nevada, parallels Highway 95 south, and continues to the repository site.

The Caliente Rail Corridor is not a desirable route because of its enormous cost of $3,000,000,000 and engineering difficulties expected along the route. The Caliente route will traverse seven north-south mountain ranges, numerous steep mountain grades, and several areas prone to flash flooding. The Caliente route traverses mostly federal land, but much of the corridor is leased by local cattleman. The rail corridor would restrict access to traditional grazing and watering sites. This corridor could also impact numerous springs and riparian areas, 97 identified Native-American archeological sites, three BLM Wilderness Study Areas and eight BLM designated wild horse or wild burro herd management areas.[57] The DOE is currently preparing an Environmental Impact Statement under NEPA for the Caliente Rail Corridor.

The U.S. Surface Transportation Board (STB) has jurisdiction over all new rail line construction in the United States. If the Caliente Rail Corridor is a mixed-use line, meaning that it will be utilized for shipping nuclear materials and other goods and commodities, the DOE is required to consult with the STB before making any final decision on construction. If the Caliente Rail Route cannot be built because of cost, engineering difficulties, and land use conflicts,[58] it makes a mostly truck scenario of shipping nuclear material to the repository very probable.[59]

Inyo County Transportation Issues

Even if the Caliente rail route is constructed, the DOE concedes that at least 10% of waste will be shipped to the repository via truck.[60] The NWPA states that transportation

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[57] Chapter 6, Environmental Impacts of Transportation, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

[58] In addition to the aforementioned land use conflicts, the Caliente Rail Corridor and repository operations could conflict with training missions for aircraft at Nellis Air Force Base.

[59] If a mostly truck shipping campaign becomes a reality, Inyo County can expect six to fourteen shipments a day for 24-38 years. *See* Task Two, Inyo County Transportation Risk Assessment Project, Transportation Scenario Estimation, Radioactive Waste Management Associates.

[60] U.S. Department of Energy, Transportation System Operations, page 10, & Chapter 6, Transportation Impacts, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

of nuclear material to Yucca Mountain will be via the Federal Interstate System. This means that the DOE is allowed to ship waste via any Federal Interstate and I-5, I-10, I-15, 1-40, and I-80 have all been previously designated by the State of California for transporting radioactive materials.[61] The DOE would likely use those interstate shipping routes for transportation of radioactive materials to Yucca Mountain.

In California, the Governor, with a recommendation from the California Highway Patrol, makes final routing designations for shipments of spent nuclear fuel and high-level nuclear waste on state highways and county maintained roads.[62] Most likely, this means that the DOE must receive permission from the Governor to ship along non-federal roadways in California.

The main transportation issue facing Inyo County is the potential truck transport of nuclear material on State Highways 127, 178, and 190. These routes began originally as wagon routes across the desert, and do not take into account the engineering demands that a prolonged truck shipping campaign of nuclear material will place on the roadways. These highways are inadequate for a truck shipping campaigns for many reasons:

1.Two-lane highway from San Bernardino County line to Nye County line
2. Limited passing lanes
3. Limited areas of highway shoulder
4. Few turnoffs
5. Flooding from the Amargosa River during spring run off or during other flood events[63]

The California Highway Patrol (CHP) would accompany truck convoys to provide security. However, due to the volume of anticipated truck shipments, the CHP would need to devote hundreds of officers, as well as vehicles and other equipment, to adequately guard truck convoys. It is anticipated this would require substantial planning among the CHP, the California Department of Transportation, and Inyo County.

The primary mitigation strategy for making these highways adequate transportation routes is to increase the width to a four-lane highway. This strategy is not desirable to the County or its residents. Several desert communities along these routes would see significant impacts from a lane widening. Impacts would include disrupting the natural character of the sensitive desert environment, noise and air quality impacts from construction crews and equipment, impacts to the free flow of traffic during the widening phase, and impacts to plant and wildlife habitat from a large amounts of pavement being

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[61] Title 13, Division 2, Chapter 6, Article 2.7-Routes for the transportation of highway route controlled quantity shipments of radioactive materials.

[62] The Western Interstate Energy Board, through the Western Governor's Association, has long recommended that the DOE and the rail and trucking industry, not the states or local jurisdictions, need to identify and analyze routes for transportation corridors. All interested governmental and tribal entities could then conduct independent assessments as to the adequacy of the routes selected by DOE. *See* Western Governor's Association Spent Nuclear Fuel Policy Resolution 05-15.

[63] *See* Tasks 2-5, Inyo County Transportation Risk Assessment Project, Radioactive Waste Management Associates; Feasibility Analysis Report for State Route 127, California Department of Transportation, 2002; and Inyo County Hazard Assessment for Highway 127, 1999.

emplaced along the route. Increased drainage from the additional pavement may also occur. Limiting and mitigating these impacts, and the frequent crossing of the Amargosa River of Highway 127, are just a few of the many engineering difficulties expected on Highway 127 alone. The 2002 Feasibility Analysis Report of State Route 127 conducted by the California Department of Transportation estimated that it would cost $275,000,000 to widen Highway 127 for a truck shipping campaign. The current cost is estimated at approximately $400,000,000. If Highway 178 or Highway 190 were selected, significant conflicts with tourism and recreation in DVNP would be anticipated.

At a minimum, the federal and state permitting processes to widen any county highway would take three to five years. It is anticipated that the United States Bureau of Land Management and the National Park Service would prepare Environmental Impact Statements under the National Environmental Policy Act due to potential environmental impacts to Death Valley National Park, the Dumont Dunes Off-Highway Vehicle Recreation Area, located just south of the Inyo-San Bernardino County line, and other surrounding federal lands. Additionally, the California Department of Transportation would perform an Environmental Impact Report under the California Environmental Quality Act and all applicable right-of-way permitting analysis.

The extent of the NRC's involvement is also uncertain with regards to the review of any transportation plan to Yucca Mountain. The NRC certifies any shipping cask as safe, and must also adopt the DOE's Rail Alignment Environmental Impact Statement. However, it is assumed that the NRC will not participate in routing criteria and selection for both truck and rail routes.

Accident Data for Highway 127

California Highway Patrol records indicate that 52 traffic collisions were reported from January 1, 2003 to March 31, 2007 on Highway 127, 35 incidents involved vehicles registered in California, and 17 incidents, almost one third of the total reported traffic collisions, involved out-of state motorists. These incidents resulted in two fatalities and 27 injuries.[64] This indicates that the Southern Inyo Fire Protection District responds to many incidents involving out of state drivers, tourists, and motorists passing through the County en route to their final destination. Also, accident "hot spots" can be identified on Highway 127. These are areas that have higher occurrence of accidents than other sections of the highway due to unsafe roadway conditions such as blind corners and lack of shoulders.[65]

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[64] California Department of Transportation records indicate that between April 1, 2000 and March 31, 2005, there were 63 accidents on Highway 127, resulting in 37 injuries and one fatality.

[65] Task Five, Inyo County Transportation Risk Assessment Project, Identification of Mitigation Strategies and Measures Designed to Maximize Public Safety on Inyo County Roads Associated with Potential Shipments of Spent Nuclear fuel and High Level Radioactive Waste, Radioactive Waste Management Associates, pages 21-28.

Current Low-Level Waste Transport by the U.S. Department of Energy on California Highway 127 and Highway 190

The DOE currently uses Highways 127 and 178 to ship low-level waste to the Nevada Test Site for disposal.[66] As recently as 2005, the DOE has used Highway 127 for shipments of low-level waste from the Nevada Test Site to the Waste Isolation Pilot Plant. These shipments will resume again in 2009. Other hazardous waste that is being transported on Inyo County's highways includes waste from U.S. Ecology (a privately-owned hazardous waste disposal site) and fireworks being transported to several large stores in Pahrump, Nevada.[67]

Since the DOE currently uses Highway 127 and 178 to ship low-level waste for disposal at the Nevada Test Site, it is reasonable to assume these routes would be desirable to the DOE to ship high-level nuclear waste to Yucca Mountain. However, the Yucca Mountain RAO does not believe any of Inyo County's highways are adequate for the type of sustained shipping campaign needed to transport nuclear materials to Yucca Mountain.[68]

Section 180 (c) of the Nuclear Waste Policy Act

Section 180 (c) of the NWPA provides grants to affected states and tribes for response training in the event of a release of nuclear material on its way to Yucca Mountain.[69] Section 180 (c) does not provide money for equipment or increased personnel needs to local first responder agencies. The DOE has stated it will make funding under Section 180 (c) available three to five years before the first shipment to Yucca Mountain.

Section 180 (c) is ineffective, both in funding and scope, to adequately train emergency responders to deal with a nuclear release. Modeling indicates that the State of California will only receive approximately $200,000 to distribute to the hundreds of local jurisdictions and first responder agencies.[70]

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[66] For current shipments of low-level radioactive waste on California Highway 127, *see* http://www.nv.doe.gov/emprograms/environment/wastemanagement/quarterlyreports.aspx.

[67] For a good discussion on commodities and hazardous materials currently on Inyo County highways, *see* Hazardous Materials Transportation on California Routes 127 and 178 with in the Southern Inyo Fire District – Healing Ourselves and Mother Earth, September 2006, *available at* http://www.inyoyucca.org/lsn.html.

[68] *See also* Inyo County Board of Supervisors Resolution # 99-9, A Resolution Opposing the Use of California Highway 127 for Shipment of Low-Level Radioactive Waste Transport to the Nevada Test Site.

[69] The language of Section 180 (c) states that "The Secretary shall provide technical assistance and funds to States for training for public safety officials of appropriate units of local government and Indian tribes through whose jurisdiction the Secretary plans to transport spent nuclear fuel or high-level radioactive waste. Training shall cover procedures required for safe routine transportation of these materials, as well as procedures for dealing with emergency response situations."

[70] Black Mountain Research, *available* at the Yucca Mountain RAO. Another approach has been proposed to fund local agencies for training, equipment, and personnel. A per-cask tax levied against the DOE or the utilities may be an equitable method to allocate funding to local jurisdictions along transportation routes.

Transportation, Aging, and Disposal Canister

The Transportation, Aging, and Disposal (TAD) canister is a multi-purpose canister designed to simplify the transport process and reduce exposure to highly radioactive spent fuel rods. The TAD utilizes one packaging system for spent fuel when it leaves the reactor site.

Utility companies seem to be less than enthusiastic about the concept of the TAD.[71] The transfer of spent fuel rods into the TADs at the utility sites requires a pool to limit radioactive exposure, yet many pools are full due to the amount of spent fuel rods that need to be cooled. It remains unclear who will pay for the cost of new packaging facilities for the TAD at reactor sites.

The DOE claims that the TAD will transport 85%-90% of the waste to the repository. Other modeling suggests that only 60% of the waste will go via the TAD. This is because about an estimated 10% of fuel rods are broken from gamma ray exposure and are unable to be disposed of in the TAD. Additionally, 10% of spent fuel is older, odd-shaped, and does not match the current configuration of the majority of spent nuclear fuel rods. Finally, TADs can only be shipped via rail and 23 commercial reactor sites, or 1/3 of the total commercial nuclear reactors, lack rail access. TAD vendors and utility companies have suggested that 50% may be a better estimate than the DOE's estimate.

As required by NEPA, a Supplemental Environmental Impact Statement detailing the TAD and other changes to surface facilities will be released in October 2007. The final comprehensive impact assessment will incorporate findings from that document.[72]

Emergency Preparedness and Response Capabilities in Southeast Inyo County

The first responder to any release of nuclear material in Southeast Inyo County is the Southern Inyo Fire Protection District (SIFPD). The SIFPD has a volunteer staff of approximately 10, with one full time paid employee who acts as Chief. Response times vary based on the location of an incident. In the past, the SIFPD has received limited training to respond to a nuclear release through the DOE's Training Emergency Preparedness Program (TEPP). It is anticipated that the SIFPD would need numerous full-time, paid employees, in addition to its current volunteer staff, if a shipping campaign to Yucca Mountain is initiated. In addition, the SIFPD would need specialized equipment and detection devices, along with a rigorous training plan to adequately deal with a release of radionuclides in Southeast Inyo County.

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[71] *Utilities unsure about nuclear waste canisters,* Las Vegas Review Journal, October 19, 2007, available at http://www.lvrj.com/news/10666256.html.

[72] The specifications for the TAD can be viewed on the Internet at http://www.ocrwm.doe.gov/receiving/pdf/tad_performance_specification_rev0.pdf.

The nearest major hospital facilities are in Las Vegas or Barstow, depending on the site of the incident. Travel times to these facilities range from one and a half to three hours away from potential truck shipping routes in Inyo County. Emergency preparedness will be addressed in the DOE's License Application. However, it is believed the LA will only address incidents at the surface faculties at Yucca Mountain, and not emergency preparedness issues in neighboring jurisdictions.

Lack of Communication Networks

Southeast Inyo County has few public phones in the several communities of the area, and cell phone coverage is extremely unreliable. If the DOE's uses Inyo County highways for a shipping campaign to Yucca Mountain, a universal telephone or radio communication network should be placed along roadways to alert the SIFPD and other emergency responders of an incident. The SIFPD would likely need significant upgrades to its current communication network. Finally, another communication system to alert local residents of a release, and rendezvous points for possible evacuation would be necessary.

Conclusion

Inyo County does not have adequate roadways for a truck shipping campaign. The County does not have the emergency response capabilities to respond effectively to a nuclear release from truck transport. The County would need additional funding to increase personnel, implement training techniques, and install communication networks. Section 180 (c) of the NWPA, the only type of federal grant available under the NWPA to assist local jurisdictions with emergency response, is inadequate both in funding and scope to allow Inyo County to achieve these essential needs.

The SIFPD would need additional funding to increase its staff with several full time employees, replace and upgrade equipment, and conduct advanced training exercises to deal with a radioactive release from a shipping campaign.

SOCIO-ECONOMIC IMPACTS

This section discusses potential socio-economic impacts to Southeast Inyo County from the Yucca Mountain Project. Broadly defined, socio-economic impacts are impacts to employment, housing, population, and public services. This section will discuss impacts to tourism, residents, devaluation of property, local services and business, wildlife, and quality of life in the region. Currently, socio-economic impacts are difficult to assess because construction of the rail line and the repository will not begin for several years, and any predicted date for the opening of the repository is speculative. Identification of many socio-economic impacts may not be feasible until after the opening of the repository. Further complicating matters is the extent to which the United States Nuclear Regulatory Commission will review socio-economic impacts, and the DOE's legal responsibility to mitigate such impacts.

A shipping campaign and repository construction and operation will likely result in significant socio-economic impacts to Southeast Inyo County. A release of radionuclides would exponentially aggravate existing impacts from an incident free shipping campaign or compliant repository operations.

Socio-Economic Impact Analysis in the Department of Energy's 2002 Final Environmental Impact Statement

In its 2002 Final Environmental Impact Statement (FEIS) for the YMP, the DOE analyzed socio-economic impacts to employment, housing, population, economic measures, Payments Equal to Taxes, and public services. While the DOE analyzed potential socio-economic impacts to Lincoln, Clark, and Nye Counties in the 2002 FEIS, no similar analysis was conducted for Inyo County. This is due to the fact that the DOE believes the potential for socio-economic impacts are greatest in the areas where repository workers will reside, and this "region of influence" consists of Lincoln, Clark, and Nye Counties.[73] Subsequently, the 2002 FEIS makes no predictions of impacts from Yucca Mountain to job growth, housing needs, population increases, the local economy, and public services in Inyo County.[74]

Many socio-economic impacts are difficult to assess and analyze because the date for construction of the rail line and the repository remains years away. However, the Yucca Mountain RAO strongly disagrees with the DOE's assertion that Inyo County is not within the "region of influence" for socio-economic impact analysis in the 2002 FEIS.

Impacts on Residents, Local Government Services, and Schools

The residents of Southeast Inyo County would feel a disproportionate burden from a shipping campaign, and repository construction and operation. Most residents cite the unique desert environment and quality of life as the primary factors to live in the area. These aspects would be negatively impacted, even with no short-term release of radioactive materials. A comprehensive evacuation system would need to be implemented in case of a release of radioactive material. This would require substantial funding and cooperation between the DOE, the State of California, and Inyo County. Any evacuation plan would also have to incorporate the Death Valley Unified School District, in addition to tourists and employees at DVNP.

Moderate impacts to the Death Valley Unified School District, most notably busses transporting children to and from school, are expected from a shipping campaign due to the anticipated volume of truck transportation on County highways. Disruption of some local government services, such as road maintenance and emergency response to non-radiological incidents, could be expected even in an incident free shipping campaign. If radiological release occurs in the area, impacts to schools and disruption of local government services would be severe.

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[73] Chapter 4, page 41, Environmental Consequences of Repository Construction, Operation and Monitoring, and Closing, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

[74] It should be noted that the DOE has no legal obligation to hire residents from Inyo County for work on the Yucca Mountain Project.

Impacts to Tourism and Local Businesses

Beginning in the 1980's, tourism emerged as the dominant force behind economic growth and revenue in the region. Local attractions in California and Nevada are numerous, to include DVNP, the China Date Ranch, Amargosa Opera House, natural hot springs and baths, bird watching, Ash Meadows National Wildlife Refuge, and Dumont Dunes Off-Highway Vehicle Recreation Area. Tourism continued to increase for approximately 20 years, until a peak of 1.5 million visitors in 2000. Since September 11, 2001, tourist recreational visits to DVNP have steadily decreased, and in 2006, DVNP had only 744,440 recreational visits.[75] The forecast for 2007 is 700,497, and the forecast for 2008 is 660,839.[76] Revenue from all DVNP visits in 2005 was $37,026,000, creating 846 jobs in DVNP.[77] The Yucca Mountain RAO estimates that an additional 50-75 jobs in Southeast Inyo County derive from the tourism industry.

Even an incident-free shipping campaign would severely impact tourism and local businesses due to the perceived stigma of transporting nuclear material. The sight of a truck convoy escorted by the CHP driving on California Highway 127 would likely cause tourists to avoid the area because of the threat of an accident and a potential radiological release. Recreational visits to Southeast Inyo County would almost certainly decrease, but since a shipping campaign is still 10 or more years away, accurately predicting the extent of such impacts is difficult. Predicting the location and severity of a radiological release, and its impacts, makes a current assessment even more difficult. The Yucca Mountain RAO believes that these types of impacts need to be identified, analyzed, and mitigated to the fullest extent by the DOE.

Transient Occupancy Taxes in the Region

The Inyo County transient occupancy tax (TOT) is a 12% excise tax on all overnight hotel rooms stays in Inyo County. TOT is a vital funding source from tourism for the County. Beginning in fiscal year 2003, through fiscal year 2007, 58%-64% of the total TOT revenue the County received was from hotels in the Death Valley region.[78] The Yucca Mountain RAO predicts that a truck shipping campaign, and construction and operation of the repository, would have a significant impact on TOT collected in Southeast Inyo County, due to an anticipated decrease in tourist visits to the region.

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[75] http://www2.nature.nps.gov/stats/.
[76] http://www2.nature.nps.gov/stats/.
[77] http://www2.nature.nps.gov/stats/.
[78] Inyo County Assessor's Office.

Devaluation of Real Property

Devaluation of property along nuclear transportation shipping corridors is a contentious issue.[79] The Yucca Mountain RAO believes that shipping nuclear materials along Inyo County's highways will lower both real and business property values. However, accurately predicting decreases is difficult. A reasonable and conservative estimate of a 2.5%-5% decrease in property values could be expected for land situated along or near highway shipping routes. That projection would be significantly higher if there were any release of radioactive material in the area.

Future residential growth, most probable in the Chicago Valley and Charleston View areas, would be impacted by the construction and operation of Yucca Mountain, as well as the shipping campaign of nuclear material to the repository. Again, impacts are difficult to assess given the many lingering uncertainties associated with the YMP. If the DOE decides to use California State Highways 127, 178, or 190 for a shipping campaign, the DOE must make a commitment to the State of California, and the residents of Southeast Inyo County, to compensate for demonstrable devaluations affecting real or business properties along or near shipping routes.

Impacts on Wildlife

Many tourists visit Southeastern Inyo County for its unique wildlife viewing opportunities.[80] A truck shipping campaign through Inyo County would have severe effects on wildlife because of the need to widen California Highways 127, 178, or 190. Repository construction and operation, as well as rail line construction, will have minimal impacts on wildlife in Inyo County. However, if there is any type of release of radioactive material associated with transportation or operation of the repository, major impacts to fauna, wildlife, and habitat would occur, depending on the severity and location of the release.

Conclusion

Many of the socio-economic impacts can be qualified, but not quantified, due to lingering political uncertainties, ambiguous planning methodologies employed by the DOE, and changing timelines of the YMP. The NEPA analysis contained in the 2002 Final Environmental Impact Statement is wholly inadequate in relation to socio-economic impacts to Inyo County because no such analysis was preformed by the DOE. The DOE does not consider Inyo County within the "region of influence" for its socio-economic

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[79] For a good discussion of differing views on decreased property values, see City of *Santa Fe vs. Komis*, 114 N.M. 659 (N.M. 1992), Property Valuation and Radioactive Materials Transportation: A Legal, Economic, and Public Perception Analysis, *available at* http://www.wmsym.org/abstracts/2003/pdfs/251.pdf, and "Get the Facts on Property Values and Nuclear Waste Transportation, *available at* http://www.nirs.org/factsheets/property.pdf.

[80] The Desert Tortoise, Amargosa Vole, Southwest Willow Fly Cather, Least Bell's Vireo, Amargosa Niterwort, and the Inyo Towhee are all found in Southeastern Inyo County, and are listed as threatened or endangered under the California Endangered Species Act or the Endangered Species Act of 1973.

impact analysis under NEPA.[81] It is highly doubtful the NRC will conduct any independent analysis of socio-economic impacts to Inyo County during the licensing hearings.[82]

[81] Chapter 4, page 41, Environmental Consequences of Repository Construction, Operation and Monitoring, and Closing, U.S. Department of Energy's Final Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and Radioactive Waste at Yucca Mountain, Nye County, Nevada, (DOE-EIS-0250) 2002.

[82] As provided in the Nuclear Waste Policy Act and the Code of Federal Regulations, the NRC must adopt any EIS that is written by the DOE in conjunction for its submission of a license application for construction authorization. The County could possibly challenge socio-economic impact analysis found in the FEIS as being incomplete if the NRC adopts the FEIS during the licensing hearings.

CUMULATIVE IMPACTS

The regulations promulgated by the Council on Environmental Quality, which implement procedural provisions of the National Environmental Policy Act, define cumulative impacts as "the impact on the environment which results from incremental impact of the action when added to other past, present, and reasonably foreseeable future action regardless of what agency or person undertakes such other actions."[83] This section will discuss past, present and future actions in the region in relation to the Yucca Mountain Project, and their cumulative effects on the natural environment of Inyo County.

[83] 42 CFR 1598.7

Cumulative Impacts to the Environment in the Region

Past and present actions that may cumulatively impact the natural environment in Inyo County are:

1. Past and present activities at the Nevada Test Site, including nuclear weapons testing, low-level waste management and storage, and the accompanying shipping campaigns.

2. Shipping campaign from the Nevada Test Site to the Waste Isolation Pilot Plant.

3. Current hazardous waste disposal at the Beatty Waste Disposal Area and at U.S. Ecology in Nevada.

4. Military operations and training at Nellis Air Force Base, Nevada.

Future actions that may cumulatively impact the natural environment in Inyo County are:

1. Construction of a rail corridor for nuclear waste shipments to Yucca Mountain.

2. Truck shipments of nuclear material through Inyo County.

3. Construction of a high-level nuclear waste repository at Yucca Mountain.

4. Storage of low-level or high-level nuclear waste at Yucca Mountain.

5. Dry cask, above ground storage of nuclear waste at Yucca Mountain or at another location at the Nevada Test Site.

6. Construction of the Ivanpah International Airport near Primm, Nevada.

7. Potential residential development in Inyo County in Charleston View and Chicago Valley.

8. Groundwater pumping by Clark and Nye Counties to support residential growth.

When considering past and present activities, as well as future actions that are reasonably forseeable, Inyo County will experience major cumulative impacts to its natural environment. The region is already highly impacted from decades of nuclear testing activities at the Nevada Test Site and by the disposal of low-level waste at the Nevada Test Site and in other sites in Nye County. If the DOE receives its license from the NRC to receive and store nuclear waste, impacts to the area will increase exponentially due to the volume and toxicity of waste being transported to Yucca Mountain for permanent disposal.

Future actions unrelated to the YMP will also cumulatively impact the natural environment, and may impact the DOE's current planning for transportation and repository operations. Pumping groundwater for future residential development in Southeast Inyo County may affect radionuclide migration rates from the repository by reversing existing gradients and altering flow paths. In addition, the construction of the Ivanpah International Airport will greatly increase the amount of visitors to the region, and will be in close proximity to transportation corridors.

Conclusion

When considering the numerous cumulative impacts, Inyo County, along with Clark, Lincoln, and Nye Counties, will be among the most impacted jurisdictions in the United States in relation to the YMP.

SUMMARY OF THE U.S. NUCLEAR REGULATORY COMMISSION LICENSING PROCESS

When the DOE submits its License Application (LA) to the NRC, the NRC will take three to six months to determine if the LA is "docketable."[84] If the NRC determines the LA is adequate, it will docket the LA and pre-hearing discovery will begin.

During discovery, parties meet to discuss the identity of participants in the proceeding, submit proposed contentions, and set future discovery schedules. Parties may rely on submissions to the License Support Network, interrogatories, depositions, and requests for admission as evidence during the licensing proceedings.

Discovery will be followed by the formal, trial-type hearings governed by the Atomic Safety and Licensing Board (ASLB). Oral and documentary evidence will be presented, and expert witnesses will give testimony and be cross-examined.

The first phase of the trial will focus on the NRC adopting, "to the extent practicable", the DOE's 2002 Final Environmental Impact Statement (EIS) for the repository under the National Environmental Policy Act (NEPA).[85] The NRC must adopt the EIS unless 1) the NRC licensing action differs from the action proposed in the LA in a way that may significantly affect the environment or 2) significant and substantial new information or consideration make the EIS inadequate.[86] If the NRC adopts the EIS, the NRC environmental review responsibilities under NEPA are satisfied. It is assumed that the NRC must adopt the 2002 Final EIS, the Supplemental EIS, and the Rail Alignment EIS.

The second part of the trial, the Safety Evaluation Review (SER), will focus on repository design and safety compliance. Entities wishing to intervene during the SER may submit contentions arguing that the DOE has failed to meet a particular legal or regulatory requirement with respect to the safety compliance point located near Gate 5-10, at the southerly edge of the Nevada Test Site.

The NWPA states that the licensing proceedings between the DOE and the NRC will last three to four years. Many believe the licensing proceedings will last far longer, primarily due to the complexity of the YMP, and also because the NRC has never analyzed an LA for a geologic repository. Whatever the decision of the NRC, it will have far reaching ramifications for our nation's nuclear waste disposal policy. To compare, the LA for Private Fuel Storage, an interim, aboveground storage facility in Utah that applied for and received its Part 63 license for disposal (the same type of license the DOE will need to construct Yucca Mountain) took almost nine years for the NRC to analyze and issue a construction authorization.

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[84] *See* 10 CFR 63.21 for contents of a License Application.
[85] 10 CFR 51.109 (c).
[86] 10 CFR 51.109 (c)(1).

The ASLB, after conducting numerous evidentiary hearings, renders its decisions on matters of controversy based on findings of fact and conclusions of law. A party can appeal any decision by the ASLB within 10 days, and must submit a detailed appeal brief within 30 days. Other parties have a right to respond to any appeal. The ASLB can affirm or deny any such appeal. The ASLB then forwards any decision to the five Nuclear Regulatory Commissioners for a final decision. The Commissioners can affirm, modify, remand, or reverse the decision of the ASLB.

Inyo County's Participation in the Licensing Proceedings

Inyo County, as a recognized AULG under the NWPA, is granted automatic standing to participate as an "intervener" in the licensing proceedings.[87] An intervener can submit contentions relying on documented evidence and expert witness testimony, cross examine witnesses, file proposed findings, and appeal decisions by the ASLB. A contention is an argument that DOE has failed to meet a particular legal or regulatory requirement when submitting the LA, or upon the NRC's adoption of any NEPA documents. Requests to intervene must be received by the ASLB no later than 30 days after publication of the docketed LA in the Federal Register.[88] Contentions must be specific, be supported by documents or expert opinion, demonstrate a dispute with the DOE on a material factual or legal issue regarding the YMP, include specific references to the application, and be within the scope of the proceeding.[89]

The second option for participating in the licensing proceeding is the Interested Governmental Participant (IGP).[90] IGP's can participate much like an intervener can, but cannot submit contentions. IGP's can comment and challenge on any admitted contention submitted by another entity.

If the Board of Supervisors chooses to intervene, and is concerned with any issues unique to Inyo, such as groundwater, it should file a contention. Otherwise, if the County wishes to merely comment on an admitted contention, participation as an IGP is recommended. The California Energy Commission will collaborate with Inyo County should the County declare itself an intervener or an IGP. Collaboration with the California Attorney General's Office during the NRC licensing process is also possible.

The State of California may choose to be an intervener or an IGP so that it can participate in the licensing proceedings as well. The California Energy Commission will be the lead state agency participating in the licensing proceedings.

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[87] 10 CFR 2.1001 & 2.309
[88] 10 CFR Section 2.309 (a) (2).
[89] 10 CFR Section 2.309 (f).
[90] 10 CFR Section 2.1001

THE U.S. DEPARTMENT OF ENERGY'S FUTURE RESPONSIBILITY TO INYO COUNTY AND THE STATE OF CALIFORNIA

If a "nuclear renaissance" is to take place in this country, the commercial nuclear industry needs a viable and permanent storage option for spent nuclear fuel. The Federal Government and the nuclear industry cite reasons such as reducing our dependence on foreign oil, growing energy demands, and combating global warming as reasons to pursue nuclear power. The NWPA mandated that the Federal Government take title to all spent nuclear fuel at commercial reactor sites by January 1998. The U.S. Treasury has paid close to $500,000,000 under breach of contract claims brought by commercial utilities for its failure to take nuclear waste off-site from reactors.

However, attainment of these goals must not come at the expense of public safety and environmental protection. If the Federal Government can provide free waste disposal to an industry which is extremely profitable, it must also work collaboratively with stakeholders and provide adequate funding for local governments to mitigate impacts and deal with emergency response capabilities.

What remains to be answered is whether Yucca Mountain is the best option our nation has to permanently dispose of nuclear waste that will be toxic for thousand of years? Above ground storage (also known as dry cask storage) has proven safe and reliable, yet this type of storage can only be utilized for approximately 100 years before a permanent disposal method must be implemented. Another advantage of above ground storage is that it can be easily managed and retrieved in the case of any radioactive release. Recycling technology, which could reduce the volume and toxicity of radioactive waste, may provide another reason to delay permanent geologic disposal in favor of temporary, above-ground storage.

Questionable quality assurance methodologies, lingering scientific uncertainties, and public distrust all plague the YMP. Since 1988, the U.S. General Accountability Office has issued eight reports criticizing the DOE's Quality Assurance and model validation programs.[91] These programs ensure the accuracy of all the DOE's methods and results from its myriad of modeling programs, and provide a foundation for all scientific research conducted at Yucca Mountain. Will the DOE ever reduce the numerous uncertainties in the modeling process to an acceptable level? There is a large body of scientific research that indicates that Yucca Mountain is not an ideal site for geologic disposal. Tectonic activity and water infiltration and migration within the mountain are commonly cited as reasons the YMP should not proceed. The DOE uses intricate computer modeling programs to evaluate groundwater flows and predict how the repository will perform over time. Such modeling is the most effective form known for making predictions, but is it reliable? Can computer modeling based on the assumptions of the DOE scientists be relied upon to predict repository performance and groundwater movement 10,000 years in the future? Finally, the DOE cannot explain what will happen

[91] Michele Boyd, Legislative Director, Public Citizen, testifying before the Subcommittee on Energy and Air Quality Committee on Energy and Commerce, U.S. House of Representatives, September 13, 2006, available at http://energycommerce.house.gov/reparchives/108/Hearings/09132006hearing2024/Boyd.pdf.

10 years in the future in terms of impact assessment, financial assistance, or collaboration with local jurisdictions. Yet it is confident that the majority of waste packages will not corrode for 10,000 years.

Many other significant uncertainties surround the YMP. There is still no rule from the U.S. Environmental Protection Agency regarding acceptable releases of radiation from the repository. The rule may still be in draft form upon submission of the LA in June 2008. Rail continues to be the preferred method of transport to the repository, yet no rail line exists to the site. It is also troubling that the DOE expects to begin its $3,000,000,00 rail line construction for the Caliente route in 2009, well before the NRC issues any construction authorization, which currently, seems uncertain at best. Further complicating matters is the DOE's primary transportation and disposal waste package, the TAD, can only be shipped by rail.

Given the numerous and lingering safety issues surrounding the repository, the DOE must commit to work collaboratively and cooperatively with Inyo County and the State of California. This must translate to substantial funding for the County and the State to mitigate impacts, upgrade emergency preparedness and response, a vigorous and transparent monitoring program, and protect citizens and the natural environment. There are serious uncertainties remaining on whether Yucca Mountain can perform the way the DOE claims it can. In light of these issues, if the U.S. Department of Energy receives construction authorization for Yucca Mountain, it must commit to working collaboratively with Inyo County and the State of California to avoid or mitigate impacts to ensure public health and safety, and prevent catastrophic damage to the environment.