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November 20, 2015

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Division of Administrative Services
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Mail Stop: OWFN-12-H08
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: Comments Regarding Supplement to the U.S. Department of Energy's Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada, Draft Report for Comment, NUREG-2184, Docket ID NRC-2015-0051

Dear Chief Bladey:

We are hereby submitting comments prepared by the State of Nevada, Agency for Nuclear Projects, on NUREG-2184, referred to hereafter as the 2015 Draft Supplement. These comments augment and reinforce Governor Brian Sandoval's letter of September 15, 2015, and Director Leo Drozdoff's letter of November 4, 2015. These comments have been prepared in coordination with the Office of Attorney General Adam Laxalt.

Governor Sandoval's letter pointed out that the applicant in this proceeding, the U.S. Department of Energy (DOE), has given up on the Yucca Mountain site, has terminated its Yucca Mountain repository program, and has sought to withdraw the license application. Governor Sandoval noted that DOE does not possess the land and water rights necessary to receive a construction authorization. Our detailed review of the 2015 Draft Supplement prepared by U.S. Nuclear Regulatory Commission (NRC) staff confirms Governor Sandoval's concern that the DOE license application proposes an unworkable waste management plan at an unsafe repository site, and that continuation of the licensing process actually impedes progress towards finding workable solutions to the problem of spent nuclear fuel and high-level radioactive waste.

Our review of the 2015 Draft Supplement leads us to conclude that the repository proposed in the Yucca Mountain license application would not protect Nevada's people and environment for the

required period of one million years, and that the 2015 Draft Supplement violates both the National Environmental Policy Act (NEPA) and the Nuclear Waste Policy Act (NWPA) as amended.

Respectfully,



Robert J. Halstead
Executive Director

RJH/sjh

Enclosure

cc Governor Brian Sandoval
Attorney General Adam Laxalt
Nevada Congressional Delegation
Chairman Richard Bryan, Nevada Commission on Nuclear Projects

**STATE OF NEVADA COMMENTS
ON THE
U.S. NUCLEAR REGULATORY COMMISSION
2015 DRAFT SUPPLEMENT TO THE U.S. DEPARTMENT
OF ENERGY'S ENVIRONMENTAL IMPACT
STATEMENT FOR A GEOLOGIC REPOSITORY FOR
THE DISPOSAL OF SPENT NUCLEAR FUEL AND
HIGH-LEVEL RADIOACTIVE WASTE AT
YUCCA MOUNTAIN,
NYE COUNTY, NEVADA (NUREG-2184)**



*Submitted By
The Nevada Agency for Nuclear Projects
Office of the Governor*

November 20, 2015

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Office of the Governor

September 15, 2015

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U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

RE: Comments regarding NUREG-2184, Docket ID NRC-2015-0051

Dear Chief Bladey:

I appreciate the efforts of U.S. Nuclear Regulatory Commission (NRC) staff to conduct public hearings and seek public comment on the Draft Environmental Impact Statement Supplement for the proposed Yucca Mountain nuclear waste repository. But as Governor of Nevada, and as someone who has been closely involved with the federal nuclear waste program for many years, I am concerned that Nevadans – and the nation – are still being forced to deal with an unsafe repository site and an unworkable waste management plan.

The time and resources being spent on the NRC Yucca Mountain licensing proceeding could be much better utilized by focusing on workable, forward-looking solutions to the country's nuclear waste problems, as recommended by the bipartisan Blue Ribbon Commission on America's Nuclear Future. Even the U.S. Department of Energy (DOE) has given up on Yucca Mountain, has terminated the DOE program, and has sought to withdraw the license application.

I recognize that the decision to go forward with the Yucca Mountain proceeding was not made by NRC, but rather was the result of an order by the U.S. Court of Appeals for the District of Columbia Circuit. Yet that same court acknowledged that NRC had inadequate funds to complete the proceeding, with the chief judge writing in dissent that it was "a useless thing" to resume the proceeding.

This dilemma is reflected in the task confronting NRC staff in the Draft EIS Supplement. As you will hear today and in written comments from Nevada representatives and others, the site is unsuitable and unfeasible due to changes in storage and transportation requirements. And as

NRC staff has already pointed out in its Safety Evaluation Report, DOE does not possess the land and water rights necessary to receive a construction authorization.

Moving beyond the failed Yucca Mountain nuclear waste repository is essential if our country is ever going to safely solve the problem of spent nuclear fuel and high-level radioactive waste. Continuation of the NRC Yucca Mountain licensing process actually impedes progress towards finding workable and expedient solutions by diverting our focus.

Sincere regards,

A handwritten signature in blue ink, appearing to read "Sandoval", is written over the typed name.

Brian Sandoval
Governor

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**STATE OF NEVADA COMMENTS ON THE U. S. NUCLEAR
REGULATORY COMMISSION 2015 DRAFT SUPPLEMENT TO THE U.S.
DEPARTMENT OF ENERGY’S ENVIRONMENTAL IMPACT
STATEMENT FOR A GEOLOGIC REPOSITORY FOR THE DISPOSAL
OF SPENT NUCLEAR FUEL AND HIGH-LEVEL RADIOACTIVE WASTE
AT YUCCA MOUNTAIN, NYE COUNTY, NEVADA (NUREG-2184)**

NOVEMBER 20, 2015

OVERVIEW OF THE STATE OF NEVADA’S COMMENTS

The State of Nevada (Nevada) comments here on the draft Supplement to the U.S. Department of Energy’s Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (NUREG-2184, August 2015) (2015 Draft Supplement), prepared by the staff of the U.S. Nuclear Regulatory Commission (NRC). These comments follow Nevada’s extensive comments to the US Department of Energy (DOE) on earlier environmental review documents for the proposed repository.

The 2015 Draft Supplement arose out of the recognition by NRC Staff, in its September 2008 Adoption Determination Report (ADR), that DOE’s 2002 Environmental Impact Statement (EIS) and 2008 supplemental EIS for the proposed repository “do not adequately characterize the potential impact of the proposed action on groundwater and from surface discharge.” (ADR, 3-12.) However, to characterize the 2015 Draft Supplement as inadequate to fulfill the “letter and spirit” of the National Environmental Policy Act (NEPA) and other federal laws would be a significant understatement. (See, e.g., 42 U.S.C. § 4231, *et seq.* (NEPA); 40 C.F.R. § 1500.1 (requiring federal agencies to comply with “letter and spirit” of NEPA).) Contrary to these requirements, NRC Staff reversed course and prepared the 2015 Draft Supplement instead of DOE, and failed to consider significant new information arising since the 2008 ADR. On the merits, scientific and legal deficiencies identified in the comments below discredit the 2015 Draft Supplement’s denial of significant groundwater and surface discharge impacts.

Moreover, NRC’s overly narrow and segmented approach in the 2015 Draft Supplement avoids the type of comprehensive and integrated environmental review NEPA requires. This deficiency underscores a consistent theme reiterated in three decades of detailed comments by Nevada and others that remain unheeded in the current 2015 Draft Supplement.

In 1985, then-Governor Richard Bryan, commenting on the Department of Energy’s draft Environmental Assessment for the Yucca Mountain Candidate Site (EA), identified numerous internal inconsistencies and reliance on unsupported conclusions, calling for more objective and integrated analysis. Fifteen years later, in comments on DOE’s draft Yucca Mountain Environmental Impact Statement, Nevada noted that, despite thousands of pages of comments submitted by Nevada and others on the EA and in scoping for the draft EIS, DOE ignored this

detailed advice and chose, instead, to undertake a document designed to support predetermined conclusions about the Yucca Mountain site and the high-level radioactive waste program.

Identifying the failure to apply a “comprehensive and integrated holistic approach” to Yucca Mountain’s environmental impact assessment as one of DOE’s draft EIS’s fundamental defects, Nevada’s draft EIS comments criticized the “piecemeal and incomplete” manner in which DOE analyzed environmental components. This truncated approach produced a document that avoided regional ecosystems and plans, failed to meaningfully address “interactions between climate change and future releases of radionuclides into the regional environment,” and evaded risks from long-term contamination that “will endanger the environment and render future natural resources unusable.”

Nevada’s comments from 2000 also remain just as valid today for the 2015 Draft Supplement. Nevada observed then that DOE’s EIS “...continues to be a minimalist environmental impact statement ratifying DOE’s predetermined and politically driven conclusion that the Yucca Mountain program will result in no significant impacts anywhere, at any time.” (Nevada DEIS comments, February 28, 2000, p. 2.). Ironically, NRC’s 2015 Draft Supplement, relying on DOE’s earlier analysis and application materials, continues that tradition of predetermination even though the project applicant, DOE, no longer supports construction of the proposed repository. As with DOE’s earlier environmental review documents for Yucca Mountain, the 2015 Draft Supplement fails to address major dangers from contaminants moving through groundwater aquifers from the repository site, which will compound greatly after engineered containers predictably and inevitably fail.

SPECIFIC COMMENTS

COMMENT 1.0

NRC STAFF PLAYED AN INAPPROPRIATE ROLE IN DEVELOPING THE 2015 DRAFT SUPPLEMENT

NRC Staff decided to prepare the 2015 Draft Supplement only after DOE reversed its position and declined to prepare it. (2015 Draft Supplement, 1-2.) This NRC Staff decision, reversing its own earlier position, was made without any prior opportunity for public comment or other public input and the Staff gave no reason for its decision. As explained below, this Staff decision violated the applicable Commission regulation.

The regulation is 10 C.F.R. § 63.24 (c), which provides that “DOE shall supplement its environmental impact statement in a timely manner so as to take into account the environmental impacts of any substantial changes in its proposed actions or any significant new circumstances or information relevant to environmental concerns bearing on the proposed action or its impacts” [emphasis added]. The regulatory history of this provision is revealing. A commenter objected to the requirement when it was proposed, fearing that a DOE failure to prepare a supplement “might be grounds for denial of a construction authorization.” The Commission rejected the

comment, stating that imposing such an obligation on DOE was appropriate in the circumstances envisioned by the proposed regulation. See 54 Fed. Reg. 27864, 27867 (July 3, 1989).

In its 2008 ADR, NRC Staff concluded that DOE's 2002 final environmental impact statement and 2008 supplement failed to address potentially significant impacts that the long-term operation of the proposed repository would have on ground and surface waters, and also identified the significance of that omission from the environmental analysis. (2008 ADR, 3-8 to 3-15) Indeed, NRC Staff found specifically that the criterion for "significant and substantial new information or new considerations [that would] render such environmental impact statement inadequate" was met for the portion of the DOE environmental documents that was supposed to consider impacts to groundwater and surface discharge over the long term. (2008 ADR 3-12) As a matter of simple logic, because the gap in information was deemed significant, it follows that information filling that gap would be significant as well.

In 2014, DOE completed its "Analysis of Postclosure Groundwater Impacts for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada," RWEPP-REP-001-Update (ML14303A399). While there are serious technical problems in DOE's analysis, it nevertheless addressed important gaps identified in the Staff's adoption determination, as well as information postdating that determination. This new DOE analysis, by its purpose, subject matter and timing, constituted "significant new ... information relevant to environmental concerns bearing on the proposed action or its impacts" within the meaning of 10 C.F.R. § 63.24 (c). Therefore, § 63.24 requires DOE to prepare the draft supplement (and any subsequent supplement) addressing the subject matter covered in the 2014 DOE analysis and the NRC Staff decision to assume this responsibility is unlawful. The Staff must abide by the Commission's regulations just as an applicant or intervenor must do. *Vermont Yankee Nuclear Power Corp. (Vermont Yankee Nuclear Power Station)*, ALAB-194, 7 AEC 431, 435 (1974); *Louisiana Power & Light Co. (Waterford Steam Electric Station, Unit 3)*, ALAB-801, 21 NRC 479, 484 (1985).

NRC's 2015 Draft Supplement should be withdrawn and DOE should be held to its original promise to prepare the necessary supplement as 10 C.F.R. § 63.24 (c) requires.

COMMENT 1.1

NRC DEMONSTRATES A LACK OF RIGOR AND INDEPENDENT ANALYSIS IN DEVELOPING THE 2015 DRAFT SUPPLEMENT

In an effort to burnish the credibility of its 2015 Draft Supplement, NRC asserted to Congress in its June 2015 Yucca Mountain progress report that "the NRC staff" had visited the Yucca Mountain area on June 10-11, 2015 "to support the Staff's analysis" in the Draft Supplement. The actual details of Staff's June "visit" instead confirm the lack of rigor in Staff's approach. This visit did not result in any factual information collected, or a single trip report, or any analyses performed, or any conclusions reached by any of the attendees. (Apparently, the only reason for the trip from Washington, D.C. and the stay at a Las Vegas hotel was to justify the statement to Congress and to preempt any accusation that the supplement was prepared entirely in NRC Staff's home office with not so much as a single site visit to Yucca Mountain.)

Another illustration of NRC Staff's absence of scientific rigor in producing the Draft Supplement can be seen by examining the pedigree of an important map replicated by NRC Staff at page 2-7 of the Draft Supplement, denominated figure 2-3. The map, illustrating numerous features in the Yucca Mountain region, including water flow direction, is not a result of any NRC Staff analysis but merely a "cut and paste" regurgitation of decades-old information.

NRC Staff makes clear in its Draft Supplement (Chapter 2, "Affected Environment") its reliance on Figure 2-3 and discusses its import. Correctly, it credits "Belcher and Sweetkind 2010" for this information. At the end of Chapter 2, NRC Staff lists references and correctly includes the Belcher document. Chapter D of the Belcher compilation is a treatise on "Hydrology" authored by Claudia C. Faunt, Frank A. D'Agnesse, and Grady M. O'Brien. Interestingly, Figure D-7 of this Hydrology treatise is a map that is identical to Figure 2-3 in Staff's 2015 Draft Supplement. The authors note on the title page that the treatise was "Prepared in cooperation with the U.S. Department of Energy." Figure D-7 of this Hydrology treatise is based on information as old as "White, 1979" (White, A. F., 1979, Geochemistry of ground water associated with tuffaceous rocks, Oasis Valley, Nevada: U.S. Geological Survey Professional Paper 712E, p. E1-E25) and is identical to NRC Staff's 2015 Draft Supplement, Figure 2-3.

A review of Belcher's 2010 compilation reveals that it "supersedes" a 2004 compilation, again by Belcher. The 2004 compendium contains a Chapter D entitled "Hydrology" whose authors were, again, Claudia C. Faunt, Frank A. D'Agnesse, and Grady M. O'Brien. The text of the 2004 Hydrology treatise is identical to that of the Hydrology treatise included by Belcher in his 2010 compilation – it is the same treatise, right down to its Figure D-7.

Put another way, in utilizing Fig. 2-3 in its 2015 Draft Supplement, NRC Staff relied upon scientific data that is decades old and had been encapsulated in maps published years before DOE filed its Yucca Mountain license application. This approach is contrary to NEPA, which places on reviewing agencies the duty to independently review and verify information relied upon in its EIS, including supporting information for a project application. See 40 C.F.R. § 1506.5.

Finally, Nevada utilized the Freedom of Information Act ("FOIA") to request the data underlying the subject map, but both DOE and NRC responded that they did not possess such data. That denial calls into serious question the accuracy and basis for reliance on the NRC Staff's August 20, 2015 Draft Supplement, Fig. 2-3.

COMMENT 2.0

THE SCOPE OF THE 2015 NRC DRAFT SUPPLEMENT IS INAPPROPRIATELY NARROW AND FAILS TO ACCOUNT FOR MAJOR DEVELOPMENTS IN THE YUCCA MOUNTAIN AND FEDERAL HIGH-LEVEL RADIOACTIVE WASTE PROGRAMS

The scope of NRC Staff's current Draft Supplement is apparently controlled by NRC's September 5, 2008 adoption decision. The ADR included, in section 3.1.2, a then-current evaluation of whether significant new information or other considerations had arisen since the

DOE's 2002 and 2008 environmental impact statements that could affect the conclusions in those documents. That was seven years ago. In apparent recognition of the passage of time, the Staff properly included in its 2015 Draft Supplement a brief summary evaluation of possible new information, concluding in section 1-2 that "since the ADR was prepared (in 2008), the NRC staff has not identified new information that would change the NRC staff's position described in detail in the ADR." This conclusion is incorrect. At least four significant events, described below, have occurred since then that could significantly affect the conclusions in DOE's environmental documents. All of them require further Staff review, both to complete the assessment of environmental impacts and to comply with applicable regulations. See, e.g., 10 C.F.R. § 109(c)(2) addressing "significant and substantial new information or new considerations"; 2008 ADR, 3-12 (applying this regulation). These significant events are:

(1) The President's March 24, 2015 decision that defense high-level wastes should be disposed of in a repository devoted exclusively to that purpose

The President's 2015 decision calling for the disposal of defense high-level waste in an exclusive repository fundamentally changes a key assumption about Yucca Mountain. Based on the provisions of Section 8(b) of the Nuclear Waste Policy Act (NWPA), the proposed action in DOE's 2002 and 2008 environmental documents - to commingle defense and commercial wastes in Yucca Mountain - would now violate the NWPA. Applying this change to Yucca Mountain and accepting only spent nuclear fuel (SNF) would change the nature of the project, invalidating and requiring redesign of the thermal management plan for the repository, and necessitating major new analysis of project impacts and the methodology used in evaluating them. (See also Comment 6.0)

(2) The President's July 10, 2015 designation of the Basin and Range National Monument

This designation may affect the conclusions in DOE's rail corridor supplemental environmental impact statement because some of the Caliente corridor transects the new Monument. (See also Comment 11.0)

(3) Termination of the program to design and utilize TAD canisters

Since DOE's Yucca Mountain license application was filed in 2008, DOE, at the end of 2009, terminated development of the TAD (transportation, aging and disposal) canisters assumed in the license application and DOE's 2008 Final Supplemental Environmental Impact Statement (FSEIS). Although these canisters were not even completed through the design phase, they nonetheless formed a key part of the technical analysis previously used to calculate contaminants at the regulatory compliance location. A large amount of spent nuclear fuel is now loaded in different canisters. If re-packaging is required, this could also give rise to significant environmental impacts not evaluated previously. Moreover, with the anticipated TAD canister no longer available and with no specific replacement selected, the repository description and performance assessment in the 2008 EIS is clearly no longer complete or accurate, and cannot provide the basis for impacts evaluated in the 2015 Draft Supplement. (See also Comment 10.0)

(4) Removal of the basis for the No-Action Alternative scenario analysis

A critical part of DOE's evaluation of the repository's no-action alternative was its evaluation of scenario 2, a total loss of institutional controls at used fuel storage sites after 100 years. Ignoring substantial earlier criticism from Nevada and other commenters, NRC's 2015 Draft Supplement simply assumed that DOE's earlier no-action alternative assessment would remain unchanged. In its "Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel" (NUREG-2157), issued in September 2014, and the related storage rule, the Commission held that this same scenario was contrary to the rule of reason and violated NEPA. Yet a fair reading of the DOE analysis is that Yucca Mountain is not the preferred option under NEPA if this scenario is eliminated from consideration. (See also Comment 17.0)

COMMENT 3.0

YUCCA MOUNTAIN'S GROUNDWATER ASSESSMENT IN THE 2015 DRAFT SUPPLEMENT CANNOT BE SEGMENTED FROM REVIEW AND DECISION-MAKING ON THE ENTIRE PROPOSED ACTION

NRC Staff's 2008 ADR highlighted two "distinct, but related" aspects of impacts on the groundwater system lacking adequate characterization: "(1) the nature and extent of the repository's cumulative impact on groundwater in the volcanic-alluvial aquifer; and (2) the potential impacts of discharge of potentially contaminated groundwater to the surface." (*Id.* at 3-10.) Finding "significant and substantial new information or new considerations" rendering these earlier reviews inadequate under 10 CFR § 51.109(c)(2), NRC staff in the 2008 ADR recommended that DOE prepare the supplement. NRC Staff prepared this Draft Supplement after DOE declined.

In these comments on the 2015 Draft Supplement, Nevada principally focuses on the Draft Supplement's failure to adequately analyze Yucca Mountain's major health and environmental dangers from impacts on groundwater aquifers and surface discharge of contaminated groundwater.

Section 114(f) of the Nuclear Waste Policy Act, 42 U.S.C. § 10134(f), expressly requires compliance with the NEPA in all particulars, except for several listed ones. Nothing in these limited exemptions removes the need to avoid completing an adequate review and analysis of Yucca Mountain's groundwater impacts. In effect, this Draft Supplement should not become a final document until all of Nevada's contentions are adjudicated and there is a complete NEPA document for the NRC's license decision.

Nevada's comments on the 2000 DOE Draft Yucca Mountain EIS (Nevada DEIS comments, February 28, 2000), which remain equally valid for the 2015 Draft Supplement, underscore the folly of marginalizing groundwater analysis as merely one of many esoteric technical assessments. Since ingestion of groundwater is the "primary human exposure pathway" at Yucca Mountain, groundwater flow and surface discharge could hardly be more central to the repository's potentially devastating long-term risks. (*Id.* at 15.) Nevada identified key deficiencies under NEPA, including irrational use of a peculiar and distant location from the

repository site for the “maximally exposed individual,” deficient groundwater modeling, and failure to “evaluate credible alternative models or opposing views of the saturated zone.” (*Id.*) DOE also failed to provide the specific disclosures and analysis required under NEPA before refusing to conduct additional analysis. (*Id.* at 15-16; 40 C.F.R. § 1502.22.) Nevada also has identified deficient assessment of other harms related to water contamination, including harms to affected Native American tribes and contamination dangers from transporting waste across the country to Yucca Mountain. (See also Comment 19.0)

Given DOE’s lengthy failure to provide the thorough and integrated analysis NEPA requires prior to its 2010 decision not to pursue Yucca Mountain, a sense of *déjà vu all over again* pervades NRC Staff’s 2015 Draft Supplement, including its all-caps portrayal of Yucca Mountain’s groundwater and surface discharge impacts as “SMALL.” (2015 Draft Supplement, 1-5.) As Nevada has long observed and has documented in its numerous pending contentions in the licensing proceeding, “the basic problem, and one that is unique to the Nevada site, is that a repository at Yucca Mountain would be positioned above the water table in an oxidizing setting where corrosive infiltrating water will rapidly degrade the waste containers. This will cause the release of radionuclides and result in radiation doses in excess of the public health standard established by the U.S. Environmental Protection Agency (EPA). This violation is expected to occur within a few hundred years of repository closure.” (M. Adams, *Yucca Mountain—Nevada’s Perspective*, 40 IDAHO LAW REVIEW 1, 3 and n. 9-11 (2010))

Beneath its conclusion that groundwater and surface discharge impacts will remain “SMALL” for the next million years, the 2015 Draft Supplement concedes its reliance on assumptions in DOE’s license application and upon groundwater flow models used in earlier analyses that remain substantively unchanged since 2008. (2015 Draft Supplement, 1-3, 2-27.) Rather than overcoming the major deficiencies in these earlier assessments, NRC Staff’s analysis in the Draft Supplement assists primarily in continuing to avoid confronting the central problems risking major environmental harm. As Nevada has summarized in recent research, including findings of DOE researchers, Yucca Mountain is “geologically incapable of isolating deadly nuclear waste for the time required.” (M. Adams, *supra*, at 3 and n. 14-18.) It is not a matter of whether Yucca Mountain will contaminate large areas of groundwater, but when.

COMMENT 4.0

PRIOR RULINGS PRESERVE THE OPPORTUNITY TO CHALLENGE ENVIRONMENTAL REVIEW AND ANY FINAL APPROVAL OF THE ENTIRE PROJECT

In *Nuclear Energy Institute v. Environmental Protection Agency (NEI v. EPA)*, 373 F.3d 1251, 1258 (D.C. Cir. 2004), the court observed that “[h]aving the capacity to outlast human civilization as we know it and the potential to devastate public health and the environment, nuclear waste has vexed scientists, Congress, and regulatory agencies for the last half-century.” The court vacated EPA’s Yucca Mountain’s radiation protection rule for Yucca Mountain, as well as the corresponding NRC regulation, concluding that limiting the compliance period to 10,000 years was not “based upon or consistent with” the contrary recommendation of the

National Academy of Sciences, in violation of Energy Policy Act section 801. The court rejected other legal challenges to EPA, including the Nuclear Energy Institute's challenge to EPA's inclusion of a separate groundwater standard.

NEI v. EPA declined to adjudicate any of the environmental review issues under NEPA and the NWPAA, opining that it remained uncertain “whether or to what extent NRC will adopt DOE's FEIS in support of any decision to authorize construction or license the operation of a repository at Yucca.” (373 F.3d at 1313.) Finding these objections unripe as presented, the court relied on assurances of NRC and DOE that “Nevada will be permitted to raise its substantive challenges to the FEIS in any NRC proceeding to decide whether to adopt the FEIS and in any DOE proceeding to select a transportation alternative.” (*Id.* at 1314.) The court also rejected as making “no sense” NRC's eleventh-hour attempt to limit this future opportunity to administrative rather than judicial proceedings (*Id.*)

Nothing in the limited mandamus order requiring NRC to resume licensing activities in *In Re Aiken County*, 725 F.3d 255 (D.C. Cir. 2013) alters the continuing opportunity of Nevada and other participating stakeholders to help ensure agency decision-making is lawful and supported by legally adequate environmental review. *Aiken* addressed pro-Yucca Mountain petitioners' efforts to require NRC to resume processing of DOE's Yucca Mountain license application. The court majority held that NRC must “promptly continue with the legally mandated licensing process” for the application “unless and until Congress authoritatively says otherwise or there are no appropriated funds remaining.” *Id.* at 267. A blistering dissent observed that “[n]o one disputes” that the \$11 million left in funding was “wholly insufficient to complete the processing of the application,” and concluded that granting the writ had directed the NRC to do a “a useless thing.” *Id.* at 269. The dissent described \$99.1 million (NRC's budget request in 2011, the last year in which it still expected Yucca Mountain to move forward) as “only the tip of the iceberg,” since it did not include amounts for DOE or others to complete the process, not to mention additional billions that would be needed to construct the repository. Based on these sobering financial constraints, the dissent opined that the mandamus order would amount to “little more than ordering the Commission to spend part of those funds unpacking its boxes, and the remainder packing them up again.” *Id.* at 270.

Aiken County left unresolved whether NRC will have sufficient resources to lawfully complete the review process for Yucca Mountain. Although the decision requires NRC to “promptly continue” the licensing process, it does not point to specific tasks or priorities or ensure their funding. The court majority acknowledged that “Congress, of course, is under no obligation to appropriate additional money for the Yucca Mountain project. Moreover, our decision here does not prejudge the merits of the Commission's consideration or decision on the Department of Energy's license application, or the Commission's consideration or decision on any Department of Energy attempt to withdraw the license application.” *Id.* at 267. While the judges disagreed on whether to issue mandamus in view of institutional and funding constraints, nothing in their opinions excuses any final decision-making on Yucca Mountain from fully complying with the law, including environmental review in compliance with NEPA and the NWPAA.

COMMENT 5.0

THE 2015 NRC DRAFT SUPPLEMENT VIOLATES THE INFORMATION QUALITY ACT AND IMPLEMENTING MEASURES ADOPTED BY THE OFFICE OF MANAGEMENT AND BUDGET (OMB) AND NRC

NRC is subject to the Information Quality Act (44 U.S.C. § 3516 note), as implemented by a January 14, 2005 OMB Bulletin (70 Fed. Reg. 2664) and by an NRC Handbook that is part of NRC Management Directive section 3.17. It seems clear that the Draft Supplement constitutes a “highly influential scientific assessment” that is “scientifically and technically novel” and should be the subject of a peer review by independent experts not employed by NRC. NRC has not provided any plans to sponsor such a review. An independent peer review is therefore not only practical and appropriate, but also required by law.

Furthermore, the February 22, 2002 OMB guidelines implementing the Information Quality Act (67 Fed. Reg. 8452) require NRC to comply here with certain generally applicable quality principles in the Safe Drinking Water Act (42 U.S.C. § 300g-1 (b) (3) (A) and (B)). The 2015 Draft Supplement does not demonstrate compliance with these principles.

The Information Quality Act

The Information Quality Act (IQA) was enacted in 2000 as a two-sentence addition to the massive (712 pages) Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554. The IQA, which appears in section 515 of that Act, requires OMB to provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility and integrity of information that is disseminated by them. The IQA provides that these guidelines shall “require” each individual agency to issue its own guidelines in an effort to achieve the same objectives.

OMB Guidance and Requirements

OMB’s final IQA guidelines were published on February 22, 2002 (“Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies; Republication,” 67 Fed. Reg. 8452). As the IQA itself suggests, the OMB guidelines apply to federal agencies that are subject to the Paperwork Reduction Act, 44 U.S.C. chapter 35. This includes NRC.

Under OMB’s guidelines, if the information is “influential” scientific information, there should be a “high degree of transparency about data and methods to facilitate the reproducibility of such information by qualified third parties” (section V.3. b. ii) (*id.* at p. 8460.). “Influential” information is defined as information that the agency “can reasonably determine ... will have or does have a clear and substantial impact on important public policies or important private sector decisions” (section V.9) (*id.*). With respect to “influential” analyses of risks to human health, safety and the environment, to assure quality agencies must either adopt or “adapt” the quality principles in 42 U.S.C. § 300g-1 (b)(3)(A) and (B) of the Safe Drinking Water Act (section V.3.b. ii. C). This has the effect of requiring agencies to adopt or “adapt” a fairly prescriptive set of requirements that include: (1) using “the best available, peer reviewed science and supporting

studies conducted in accordance with sound and objective scientific practices’; (2) using data “collected by accepted methods or best available methods (if the reliability of the method and the nature of the decision justifies use of the data”); and (3) presenting data in a way that is “comprehensive, informative, and understandable.” Item (3) requires that the agency include, to the extent practicable, (a) each population addressed by a risk estimate, (b) the expected risk or central estimate of risk for the affected populations, (c) each appropriate upper-bound or lower-bound risk estimate, (d) each significant uncertainty that is identified and the studies that might resolve them, and (e) peer-reviewed studies known to the agency that are relevant, whether supportive or not supportive, and the methodology use to reconcile inconsistencies in the scientific data.

OMB Guidance and Requirements on Peer Review

On January 14, 2005, OMB issued a “Final Information Quality Bulletin for Peer Review” pursuant to, among other authorities, the IQA (70 Fed. Reg. 2664). The Bulletin supplements the IQA guidelines by providing “minimum standards” for when peer review is required and guidance on how peer reviews should be conducted (*Id.* at p. 2666). Application of the bulletin is limited, in the first instance, to “dissemination” of “influential scientific information” by agencies subject to the Paperwork Reduction Act (including NRC). “Influential” scientific information is defined as information that the agency “reasonably can determine will have or does have a clear and substantial impact on important public policies or private sector decisions” (section I.6, 70 Fed.Reg. at p. 2675). This definition is the same as the counterpart definition in the OMB guidelines.

To the extent permitted by law (which should not be a limitation as applied to NRC), the Bulletin requires agencies such as NRC to “conduct a peer review of all influential scientific information that the agency intends to disseminate” (section II.1, *id.* at p. 2675). Minimum peer review attributes include selection of reviewers based on expertise, experience and skills, including multiple disciplines as necessary, and an expert selection that is sufficiently broad and diverse “to fairly represent the relevant scientific and technical perspectives and fields of knowledge;” avoidance of conflicts of interest; and non-involvement in conducting the scientific work being reviewed (section II. 3, *id.*). The peer reviewers must be identified and a report must be prepared that describes either their individual comments or that represents the views of the group as a whole with any dissenting or disparate views (section II. 5, *id.*). Also, peer review planning must be conducted and published (section V, *id.* at pp. 2676-2677).

OMB explained further that “[m]ore rigorous peer review is necessary for information that is based on novel methods or presents complex challenges for interpretation. Furthermore, the need for rigorous peer review is greater when the information contains precedent-setting methods or models, presents conclusions that are likely to change prevailing practices, or is likely to affect policy decisions that have a significant impact” (*id.* at p. 2668). For this reason, the bulletin applies especially stringent peer review requirements to a subset of “influential scientific information” called “highly influential scientific assessments” (section III, *id.* at p. 2671).

“Highly influential” is defined as scientific information that could have a potential impact of more than \$500 million in any year or that is “novel, controversial, or precedent-setting or has significant interagency interest (section III, *id.* at p. 2671). “Scientific assessment” is defined as an “evaluation of a body of scientific or technical knowledge, which typically synthesizes multiple factual inputs, data, models, assumptions, and/or applies best professional judgment to bridge uncertainties in the available information [including] safety assessments” (section I.7, *id.* at p. 2675).

The additional and more stringent requirements include: (1) with very limited exceptions, no scientist employed by the sponsoring agency may be a peer reviewer; (2) no repeated use of the same reviewer on multiple assessments unless his or her participation is essential and cannot be obtained elsewhere; (3) provision of sufficient information to peer reviewers; (4) whenever feasible and appropriate, provision of the scientific information in draft form for public comment and a public hearing at the same time it is submitted for peer review or during the peer review process; and (5) a detailed written agency response to the peer review report (section III. 3, 4, 5, and 6, *id.* at p. 2676).

NRC Implementation

NRC published its IQA guidelines on October 1, 2002 (NRC Information Quality Guidelines, 67 Fed. Reg. 61695) and further implemented the IQA in its April 9, 2009 “Management Directive 3.17, NRC Information Quality Program.”

IQA Guidelines

NRC’s quality standards are intended to “expound” on how NRC will meet OMB guidelines. They provide generally that information, including third-party information, that NRC relies on or disseminates “must meet” both the NRC Information Quality Standards and OMB guidelines. Consistent with OMB’s guidelines, NRC will impose the highest level of quality on “influential” scientific, financial, or statistical information. The NRC’s guidelines provide that certain NRC rules deemed to be “major” should also be “influential”, but that other information may be determined to be “influential” based on consideration of two principal factors: (1) the information may have a clear and substantial impact that has a high probability of occurring, and (2) the information may impact regulatory decisions affecting a broad class of applicants or licensees. NRC states further that information contained in a regulatory decision for an individual applicant or licensee “may not” be deemed “influential” for the purposes of the guidelines “because it is limited in its breadth” (67 Fed. Reg. 61697).

As noted, for “influential” analyses of risks to human health, safety and the environment, to assure quality, agencies must either adopt or “adapt” the quality principles in 42 U.S.C. § 300g-1 (b)(3)(A) and (B) of the Safe Drinking Water Act (section V.3.b. ii. C). The NRC’s guidelines do not mention the Safe Drinking Water Act. Clearly, NRC has chosen to adopt rather than “adapt” these quality principles because an “adapt” decision would require discussion and justification that are missing entirely from the NRC’s guidelines.

The Commission characterized its IQA guidelines as a non-binding policy statement. This means that they constitute a statement of current intent that is subject to future change on a case-by-case basis. While NRC is not strictly bound by them, NRC must nevertheless explain any departures from these guidelines to demonstrate principled decision-making. *See e.g., New Jersey v. NRC*, 526 F.3d 98, 102-103 (3rd. Cir. 2008); *Limerick Ecology Action, Inc. v. NRC*, 869 F.2d 719, 734 (3rd. Cir. 1989); *Mississippi Power & Light Co. (Grand Gulf Nuclear Station, Units 1 & 2)*, ALAB-704, 16 NRC 1725, 1732 note 9 (1982).

Nevada is entitled to cite the guidelines as an expression of current Commission practice and policy and to expect NRC Staff to comply with the guidelines or, at the least, explain why it will not comply and obtain the Commission's approval for the non-compliance.

IQA Management Directive

Management Directive 3.17 supplements the NRC's IQA guidelines. The Directive itself is only nine pages long and consists of delegations of authority to various NRC officials to take actions related to information quality and correlative descriptions of officials' obligations. Of greater importance, the Directive incorporates a "Handbook 3.17." In the NRC management system, Handbooks are intended to "facilitate employee compliance with agency policy as stated in the controlling directive" (NRC Mgt. Dir. 1.1 at p. 6). Handbook 3.17 is entitled "NRC Information Quality Program" and is described as containing "detailed procedures on the NRC Information Quality Program" (NRC Mgt. Dir. 3.17, p. 8).

Table 1 of the Handbook lists NRC information products considered subject to the IQA guidelines. Licensing environmental impact statements are listed specifically in Table 1 (covered by the guidelines). Table 2 lists documents not covered. Licensing environmental impact statements are not listed here as excluded.

Table 2 lists "Adjudicatory Documents" as not covered. This exclusion is necessarily based on the OMB guideline exclusion of documents whose dissemination is limited to adjudicative processes. OMB explained that this exclusion from the IQA was intended "to exclude ... the findings and determinations that an agency makes in the course of adjudications involving specific parties." (67 Fed. Reg. 8452, 8454, Feb. 22, 2002.) OMB explained further that "[t]here are well-established procedural safeguards and rights to address the quality of adjudicatory decisions and to provide persons with an opportunity to contest decisions. These guidelines do not impose any additional requirements on agencies during adjudicative proceedings and do not provide parties to such adjudicative proceedings any additional rights of challenge or appeal." (*Id.*).

This exception was upheld in *Prime Time International Company*, 599 F.3d. 678, 685-686 (D.C. Cir. 2010). *Prime Time* involved a challenge to an agency adjudicatory decision involving a Federal payment to a cigar producer. The NRC equivalent would be an attempted IQA challenge to a final adjudicatory decision by an administrative judge or atomic safety and licensing board. Clearly, the exclusion for adjudicatory documents in the OMB guidelines and the NRC Management Directive applies only to adjudicatory decisions; it does not apply to documents prepared by NRC Staff (such a licensing environmental impact statements and safety evaluation

reports listed as covered in Table 1) as a party to (but not a decision-maker in) the adjudicatory proceeding.

As was true for the NRC's guidelines, the Management Directive does not mention the quality principles in the Safe Drinking Water Act. The necessary implication is that the quality principles of the Safe Drinking Water Act have been fully adopted by NRC.

A Management Directive (such as Management Directive 3.17) may be used by affected persons as a basis to request relief, *Shieldalloy Metallurgical Corporation (Decommissioning of the Newfield, New Jersey Site)*, CLI-11-12, 74 NRC 460, 497-498 note 145 (2011), and NRC Staff has cited criteria in Management Directives as the basis for decision. *See e.g., Entergy Nuclear Vermont Yankee, LLC, et al. (Vermont Yankee Nuclear Power Station)*, DD-11-03, 73 NRC 375, 379 (2011). The Commission has also stated that Management Directives function both as a kind of official interpretation of a statute and as a statement of Commission expectations for its Staff in fulfilling its obligations under the statute in question. *Amergen Energy Company LLC (Oyster Creek Generating Station) et al.*, CLI-08-23, 68 NRC 461, 482 (2008).

As is the case with the NRC IQA guidelines, Nevada is entitled to expect that NRC Staff will comply with an applicable Management Directive or, at the least, explain why it will not comply and obtain the Commission's approval for the non-compliance..

Application to the Draft Supplement

As explained above, NRC has adopted the quality principles in the Safe Drinking Water Act and applied them to "influential" NRC analyses of risks to human health, safety and the environment. Furthermore, under the OMB bulletin and the NRC Handbook, NRC must conduct a peer review of all "influential" scientific information that the agency intends to disseminate unless the information falls in an exempt category, none of which apply to the 2015 Draft Supplement. Indeed, as noted above, Table 1 of the NRC's Handbook specifically lists licensing environmental impact statements as subject to the IQA. Especially stringent peer review requirements apply to a subset of "influential scientific information" called "highly influential scientific assessments."

The definition of "influential" is important here. As noted, OMB defines "influential" information as information that the agency "can reasonably determine ... will have or does have a clear and substantial impact on important public policies or important private sector decisions." (67 Fed. Reg. 8452, 8460.) Clearly, the 2015 Draft Supplement meets the OMB definition because of its clear and substantial impact on national waste disposal policy. For example, Yucca Mountain proponents have cited the Draft Supplement to support their view that the project should be funded and the licensing proceeding should be completed, and the viability of Yucca Mountain is a key issue in Congressional consideration of the recommendations of the Blue Ribbon Panel and changes to the Nuclear Waste Policy Act. *See, e.g., "Opening Statement of the Honorable John Shimkus Subcommittees on Energy and Power and Environment and the Economy Hearing on 'Oversight of the Nuclear Regulatory Commission' September 9, 2015."* Moreover, the Draft Supplement also meets the OMB definition because it will have a clear and substantial impact on private sector decisions regarding continued storage of spent nuclear fuel.

The NRC guidelines require consideration of two principal factors in deciding whether an information product is “influential”: (1) the information may have a clear and substantial impact that has a high probability of occurring, and (2) the information may impact regulatory decisions affecting a broad class of applicants or licensees. The Draft Supplement meets criteria (1) and (2) for the same reason it satisfies the OMB definition. NRC states further that information contained in a regulatory decision for an individual applicant or licensee may not be deemed “influential” for the purposes of the guidelines “because it is limited in its breadth.” The operative phrase here is “may not,” not the mandatory “shall not,” and the clear and substantial impacts of the Draft Supplement on waste disposal policy and private sector decisions regarding spent nuclear fuel storage undercut any notion that the impacts from the Draft Supplement are limited in breadth. In any event, the Draft Supplement is not a “decision.”

Moreover, the 2015 Draft Supplement falls in a category of “influential” information products called “highly influential scientific assessments.” As noted, a “scientific assessment” is an “evaluation of a body of scientific or technical knowledge, which typically synthesizes multiple factual inputs, data, models, assumptions, and/or applies best professional judgment to bridge uncertainties in the available information” and a scientific assessment becomes “highly influential” if it is “influential” and “novel, controversial, or precedent-setting or has significant interagency interest.” (70 Fed. Reg. 2664, 2676.) These definitions fit the Draft Supplement exactly.

Conclusion

The 2015 Draft Supplement has not been the subject of any peer review that meets IQA requirements and related guidance documents. Yet the 2015 Draft Supplement clearly is a highly influential scientific assessment that must be the subject of a compliant peer review. As noted, applicable peer review requirements include a provision that no scientist employed by NRC may be a peer reviewer and a provision requiring a detailed written agency response to the peer review report.

The 2015 Draft Supplement is also an “influential” analysis of “risks to human health, safety and the environment.” Therefore, Safe Drinking Water Act principles apply fully. The quality principles in the Safe Drinking Water Act require (1) use of “the best available, peer reviewed science and supporting studies conducted in accordance with sound and objective scientific practices”; (2) use of data “collected by accepted methods or best available methods (if the reliability of the method and the nature of the decision justifies use of the data”); and (3) presenting data in a way that is “comprehensive, informative, and understandable.” Item (3) requires that the agency include, to the extent practicable, (a) each population addressed by a risk estimate, (b) the expected risk or central estimate of risk for the affected populations, (c) each appropriate upper-bound or lower-bound risk estimate, (d) each significant uncertainty that is identified and the studies that might resolve them, and (e) peer-reviewed studies known to the agency that are relevant, whether supportive or not supportive, and the methodology use to reconcile inconsistencies in the scientific data.

The 2015 Draft Supplement does not comply with these Safe Drinking Water Act requirements. Among other things, it provides no upper-bound or lower-bound risk estimate of the impacts on ground or surface waters, no specific identification of the central risk estimate, no claim that all significant uncertainties had been identified or any identification of the studies that might resolve them, and no claim that all known and relevant peer-reviewed studies had been considered.

Prior to any future reliance on the 2015 Draft Supplement, it must receive a peer review by qualified experts not employed by NRC. No supplement can proceed for Yucca Mountain until after peer review results are disclosed and comments received. Moreover, the 2015 Draft Supplement must be revised to comply fully with principles of scientific quality set forth in the Safe Drinking Water Act and made applicable to the Draft Supplement by OMB guidance promulgated under the Information Quality Act.

COMMENT 6.0

THE NRC 2015 DRAFT SUPPLEMENT FAILS TO CONSIDER THE IMPLICATIONS OF THE MARCH 24, 2015 PRESIDENTIAL DIRECTIVE RESCINDING THE 1985 DECISION TO COMMINGLE DEFENSE HIGH-LEVEL WASTE (HLW) AND COMMERCIAL SPENT NUCLEAR FUEL (SNF) IN A SINGLE REPOSITORY

The 2015 Draft Supplement does not acknowledge the March 24, 2015 Presidential Memorandum reversing the 1985 commingling decision and its potential consequence to the analysis of groundwater impacts and impacts of groundwater discharges of radionuclide contaminants from a Yucca Mountain repository.

The most important consequence of the proposed repository as designed but with no defense high-level waste (HLW) is that the thermal management plan for the repository would be completely invalidated. The repository thermal design relies on the thermal buffering effect provided by the significantly cooler DOE co-disposal packages to assure that all required thermal limits are not exceeded. The various thermal limits have important and unique rationales, but taken together the thermal design and management of the thermal pulse following repository closure constitutes a key factor in the intermediate and final outputs of the Total System Performance Assessment (TSPA), including the mean mass radionuclide flux at the regulatory compliance location.

The issue is further complicated by consideration that the burnup and cooling, and hence heat output, of an additional 7,000 MTHM (metric tons heavy metal) of commercial spent nuclear fuel (SNF) would differ from that of the 63,000 MTHM previously assigned to the repository. This additional SNF could potentially be of higher burnup and/or shorter cooling period than that of the SNF previously proposed for disposal. Indeed, it is possible that the additional capacity and delay since the current disposal inventory was proposed, could lead to a more radical revision of the disposal strategy for all 70,000 MTHM, resulting in a need to reconsider both the thermal design and the radionuclide inventory used as a basis for the post-closure assessment calculations.

The Draft Supplement does not recognize that, as a consequence of the Presidential Memorandum of March 24, 2015, if a Yucca Mountain repository is to proceed toward licensing, it must be reviewed as a repository with no defense HLW. This requires a revision of the license application and all NEPA related documentation to accommodate the changed waste inventory and the need for a revised repository thermal design for input to a new TSPA. The output of the current DOE TSPA is not valid for use as a source term for NRC's 2015 Draft Supplement.

COMMENT 7.0

THE 2015 DRAFT SUPPLEMENT IMPROPERLY BASES ESTIMATES OF GROUNDWATER CONTAMINATION AND RELATED ENVIRONMENTAL IMPACTS ON OUTPUT FROM THE DISCREDITED AND OBSOLETE DOE TOTAL SYSTEMS PERFORMANCE ASSESSMENT

Appendix A to the 2015 Draft Supplement confirms a fatal flaw in NRC Staff's benign assessment of environmental impacts. The results in the Draft Supplement rely entirely on the reliability of a severely flawed performance assessment earlier used by DOE to generate results in modeling runs. The Draft Supplement inappropriately uses output from this TSPA as its source term for radionuclide fluxes, a composite output from TSPA cases provided by DOE in its Yucca Mountain license application (TSPA-LA).

This source term is described in Appendix A to the NRC Draft Supplement (Section A.1), which states that the 2008 SEIS produced by DOE used mean results for 300 TSPA realizations to construct a combined scenario case that included the nominal, early failure, igneous intrusion, and seismic ground motion – fault displacement scenario classes. These simulations produced the mass fluxes of radionuclides arriving at the compliance location (location of the reasonably maximally exposed individual (RMEI)) as a function of time. These results are used by NRC as the source term for calculations of transport beyond the regulatory compliance location (page A-3, line 37 et seq.).

As a result, the results presented in the 2015 Draft Supplement rely fully on the TSPA, not just in respect to one scenario class, but over all four scenario classes. Nevada has challenged the reliability of the TSPA in numerous pending safety contentions. Furthermore, a large proportion of those contentions relate to radionuclide retention in the engineered system and to radionuclide transport through the unsaturated and saturated zones. These contentions challenge not only the radiation doses evaluated using the TSPA, but also the radionuclide fluxes calculated at the compliance location, which form the starting point of the NRC analysis.

Furthermore, as detailed below, the radiological impact calculations undertaken in the Draft Supplement rely on similar underlying models and data to those DOE relied upon earlier in support of its licensing application, particularly for well abstraction at Amargosa Farms. Accordingly, these calculations are subject to the deficiencies identified in the biosphere-related safety contentions submitted by the State of Nevada.

Sound technical and scientific reasons, including those below, discredit the basis for using the TSPA-LA results in calculations underpinning the 2015 Draft Supplement because only mean

fluxes are used as a basis for the analysis. Nonetheless, the 2015 Draft Supplement provides no indication of the uncertainty and variability in environmental impacts within and between scenario classes. Because analysis of such uncertainty and variability is central to the estimation of dose results for the RMEI, it is unreasonable not to present any information on this topic for the other environmental impacts that have to be addressed in the Draft Supplement.

The 2015 Draft Supplement's environmental analysis will remain incomplete unless and until Nevada's numerous pending TSPA contentions are addressed and resolved. NRC Staff has not specifically addressed these contentions in Safety Evaluation Report (SER), Volume 3 or elsewhere. Nevada highlights below some of the major problems with continued reliance on DOE's TSPA, as well as broader problems with the analysis of Yucca Mountain's consequences that will remain relevant even if the performance assessment is later revised or replaced. NRC's reliance on DOE's TSPA-LA source term as the basis for estimating groundwater contamination and resultant environmental impacts is unsupported for at least the following reasons, which are fully discussed and justified in Nevada's TSPA contentions:

7.1 The 2015 Draft Supplement fails to consider that the range of climate conditions is too narrow and there are potential future climatic regimes that would result in larger amounts of infiltration than are considered by DOE.

DOE has failed to take into account the rapid and continuing developments in understanding of the global climate system and the factors that will determine future changes in climate. There are both natural effects, notably those arising from changes in the Earth's orbital characteristics, and human-induced effects, notably due to continuing emissions of greenhouse gases. Contrary to sound science, DOE presumes that past changes in climate provide an adequate basis for assessment, but future changes in climate have the potential to generate no-analog conditions. This possibility can readily be investigated using a variety of mathematical models of the climate system, but DOE has not done this. These models reveal that rainfall intensities during storms could be much greater than has been observed historically. This could activate pathways for fast flow of water through the unsaturated zone and into the repository drifts. There is already evidence of such fast-flow pathways, but their influence could be substantially enhanced by future climatic conditions that might combine general aridity with intense storms. In fact, the 2015 Draft Supplement concludes that the principal effects of a climate that is warmer and drier than that at the present day is to delay the release and transport of contaminants from a repository. (2015 Supplement, 2-17.) Nevada experts dispute this premise, finding that a warmer and drier climate may be associated with a decrease in vegetation cover and an increase in intensity of infrequent large precipitation events. It is likely that such events will be a principal determinant of infiltration at Yucca Mountain. If this is the case, then a warmer and drier climate may paradoxically increase contaminant fluxes to the groundwater aquifer.

Even within its own framework of reference of using past conditions at Yucca Mountain or present conditions elsewhere as analogs of future conditions, the DOE approach is deficient because it uses inappropriate analog stations and aggregates data from them in an invalid way.

After development of a scenario for future changes in climate in the general area of Yucca Mountain, there remains the issue of how precipitation occurring under the projected changes in climate should be represented mathematically for use in the TSPA. For this purpose, DOE has used a deficient model based on inappropriate calibration and sampling procedures and inadequately qualified data and that were not subject to suitable peer review, although alternative models exist that are consistent with the available data and scientific understanding. Furthermore, beyond 10,000 years, DOE has used a deep percolation rate prescribed by regulation rather than using scientific arguments to justify a range of deep percolation rates that may apply over that period. Even if nominally allowed as a method to perform a safety evaluation in compliance with Part 63, Part 63 does not excuse NRC Staff from conducting an evaluation under NEPA that is complete and scientifically supportable.

Thus, the climate and precipitation models used by DOE cannot be relied upon, and there is evidence that future patterns of precipitation, e.g. involving very high intensity storms, could give rise to pulses of infiltration that could rapidly and substantially impact the proposed repository.

7.2 In the long-term, erosion at the proposed repository location would substantially affect the pattern and amount of infiltration, and could even result in exhumation of the proposed repository.

This technical issue is relevant to the environmental impact assessment, since it shows that erosion could both alter infiltration in the shorter term and exhume the repository in the longer-term, exposing radioactive wastes at the surface when they still retain significant concentrations of longer-lived actinide elements.

7.3 The amount and spatial pattern of infiltration has been inadequately characterized and modelled.

DOE used the MASSIF model to estimate infiltration, and the NRC Staff has not changed that reliance in the 2015 Draft Supplement. This model neglects relevant hydrological and other processes and uses crude approximations or arbitrary procedures for those it does represent. It does not take account of the effects of climate change on vegetation nor does it use appropriate initial conditions. Furthermore, it fails to adequately represent infiltration at the sub-daily scale or to simulate rare extreme events, both of which are key to estimating event-driven infiltration. Notwithstanding these deficiencies, no alternative conceptual models were used and the only comparison made with an alternative mathematical model was seriously flawed.

Problems with the scope and structure of the model are compounded by a lack of relevant data for its calibration and testing. The spatial and temporal distribution of precipitation at Yucca Mountain is inadequately quantified, the soil properties data are inadequate, as are the data on rock properties and major faults. However, not only are the data inadequate, they are then improperly handled, with inappropriate aggregation procedures, invalid exclusion criteria, indefensible choices or parameter ranges and distributions and failure to properly account for parameter correlations. Where data were available, they were not necessarily used to verify

model estimates. Where corroboration of model results was attempted, it failed because of the use of an inappropriate basis of comparison.

Perhaps not surprisingly, when results from the model were compared with the limited site-specific data, model performance was demonstrated as unacceptably poor.

Finally, when the results from the MASSIF model were used to estimate long-term mean net infiltration, the approach adopted was statistically unsound.

7.4 The flow through the unsaturated zone above the proposed repository has been inadequately characterized and modelled by DOE, resulting in seriously underestimating the potential significance of fast-flow pathways.

The key issue is that the tuffs that comprise Yucca Mountain are highly complex and heterogeneous and fast-flow pathways are known to exist. DOE rates these as being of little significance, but its modelling approach lacks a physical basis. In particular, the Paintbrush non-welded unit is not properly modeled, so there can be no confidence that it will attenuate episodic events. In a situation where a substantial fraction of the water flow may be by fast-flow pathways, extreme infiltration events that are left undefined by DOE could have a disproportionate effect on repository integrity. DOE has argued that geochemical data mitigate against the significance of fast pathways either now or in the past, but the available data are either not as supportive of this view as has been argued by DOE or positively contradict it.

7.5 Multi-phase flow characteristics in the thermo-hydro-mechanical-chemical system that is characteristic of the near-field of the proposed repository are poorly understood and inadequately modelled, leading to substantial uncertainties in the amount and chemical composition of water that could contact the engineered components of the system.

Groundwater flow around the proposed repository occurs in a fractured medium. DOE unsatisfactorily represented this medium in a continuum approach, which the 2015 Draft Supplement does not change. In some contexts, the same system is described in terms of two contradictory models, leading to inconsistencies in the results obtained. Even where it might be appropriate to use a continuum approach, the approach adopted to model parameterization is invalid and recognized hysteresis and flow-rate dependent effects are neglected.

In the early post-closure period, the heat released from the disposed waste is a major factor controlling flows of water in the near-field. However, perturbations to flows of heat and water due to major components of the engineered system are neglected and the models used are inadequate because of coarse discretization and an inadequate representation of feedback effects.

7.6 The mechanical stability and corrosion resistance of the engineered components of the proposed repository system cannot be guaranteed over the range of conditions that could occur, so earlier and more substantial releases of radionuclides from the engineered system than are envisaged by the TSPA are likely.

The two main elements of the engineered system are the waste containers and overlying drip shields. In the TSPA-LA calculations, the drip shields are assumed to be correctly emplaced, but

these drip shields may never be emplaced or may be improperly installed, so that water can penetrate between them. Furthermore, the design information for the drip shields cannot be guaranteed to be sufficiently mechanically strong to perform their functions. Also, even if appropriately designed, there are a wide variety of fabrication errors that could result in their early failure. A particular concern is the use of two different grades of titanium for the water diversion surface and the structural components. This raises several issues relating to problems of welding these two grades together, including hydride formation, stress relief, determination of mechanical and corrosion properties, and achievement of an optimum aluminum gradient across the weld. Taken together, these considerations strongly suggest that no reliance should be placed on the drip shields when assessing the post-closure performance of the proposed repository.

The waste packages and drip shields are proposed to be located in drifts where they are potentially exposed to rock falls and drift collapse. However, the geomechanical properties of the host rock have not been adequately characterized and rubble loading may be sufficient to collapse the drip shields, particularly bearing in mind concerns over fabrication errors and mechanical properties mentioned above. Furthermore, the situation may be exacerbated if the ground-support system is less durable than is envisaged by the TSPA or if the drip shield is made brittle by hydride formation resulting from general corrosion of the material.

If the waste packages and drip shields are emplaced as intended, they will be subject to corrosion arising from groundwater infiltrating into the drifts. The composition of the water that contacts the waste packages and drip shields will be determined both by the natural composition of the groundwater and by its interactions with components of the engineered system. Unfortunately, DOE has failed to adequately characterize the range of groundwaters of relevance or to address the thermo-hydro-chemical evolution of those waters prior to infiltration into the drifts. DOE also argues that rates of groundwater entry into the drifts will be limited by the creation of a dry zone above the drifts in the initial thermal period and by capillary barrier effects at all times. However, non-steady state water flows into the drifts can occur during the high temperature phase, the effectiveness of a capillary barrier effect is not assured and engineered ground-support items, such as rock bolts, can facilitate water entry during both the thermal and ambient temperature phases. Contrary to DOE assumptions, structural controls may result in seepage being directed to specific locations or areas, affecting the overall pattern and extent of corrosion.

Due to heat production by the wastes, considerable evaporation of infiltrating groundwaters will occur, resulting in the presence of brines or evaporative solid deposits containing fluid inclusions on the drip shields and waste packages. The compositions of the brines are uncertain and these uncertainties have been underestimated by DOE. DOE also has neglected to consider the significance of complex deliquescent salts. The properties of the contacting brines and associated solid deposits are such that they can be effective agents of corrosion of both the drip shields and waste packages. Concentrated salt solutions and molten salts that are capable of causing corrosion can be formed up to the maximum operating temperatures expected and are liable to change the mechanism by which corrosion occurs.

In addition, dust may be deposited on the drip shields and waste packages, facilitating condensation and deliquescence that can generate a corrosive environment. DOE has poorly

characterized the dusts that could be present and, in particular, has neglected the organic components that could be included, steel dusts that could contain reactive trace elements and newly mineralized coronadite or lead carbonates. The presence of dust deposits on drip shields and waste packages can facilitate localized corrosion, which can also be facilitated by the presence of debris fields on waste packages that have arisen from drip shield degradation. Debris fields can also arise on drip shields and waste packages from the degradation of ground support components. This process is neglected by DOE. Localized corrosion of the drip shields is likely to be enhanced in crevices at their interconnections, a process that is also neglected by DOE.

Organic matter provides a substrate for, and includes, microbial populations. Although DOE predicts limited microbial activity in the repository, this arises because of its neglect of extremeophiles that would likely flourish in such conditions. Microbial populations can influence the chemistry of waters in the unsaturated zone and can influence corrosion. DOE does not recognize the significance of microbial influences on water chemistry and fails to represent microbial corrosion appropriately, e.g. because of a failure to appreciate the significance of microbial denitrification.

Although DOE has recognized the potential importance of drip shield and waste package corrosion, the corrosion tests that it has undertaken have largely been in inappropriate, static solution conditions using inappropriate water, at temperatures at the low end of the range of interest and neglecting to adopt standard procedures such as solution replenishment. In addition, the results obtained were inaccurate because differential mass loss procedures were used to measure very low corrosion rates and the solutions used were contaminated by organic and inorganic materials, possibly from the outset. Use of inappropriate solutions, experimental techniques and measurement protocols was associated with over-interpretation of the results, e.g., with respect to decreasing corrosion rates. Also, DOE has neglected to consider that surface oxide films on titanium resulting from stress-relief annealing may enhance general and under-deposit corrosion.

Where more appropriate studies have been undertaken for the State of Nevada, using a wet-dry cycle, inter-granular stress corrosion cracking has been observed.

DOE also places reliance on high nitrate to chloride ratios to suppress corrosion of Alloy-22. However, the experiments on which reliance is placed were immersion tests not representative of unsaturated zone groundwaters in either composition or mode of delivery. Also, DOE takes no account of the electrochemical reduction of nitrate during passive corrosion processes leading to severe localized corrosion.

A particular concern with the Alloy-22 alloy used for the waste packages is the possibility that trace elements from the alloy will accumulate at the surface and induce very high generalized and local corrosion rates, as well as stress corrosion initiation and propagation.

When one or more waste packages are breached, additional considerations arise that could exacerbate further degradation. For example, fluoride and boric acid could be released from breached high-level radioactive waste (HLW) packages and result in increased corrosion of both

drip shields and other waste packages. Rates of HLW glass degradation could be larger than assumed by DOE. These issues may not arise if defense wastes are excluded from the proposed repository, but new issues then arise concerning changes in the radionuclide inventory and thermal regime that would impact the TSPA-LA results in other ways.

7.7 Limitations of the studies that have been undertaken mean that the rates of transport of released radionuclides through the unsaturated and saturated zones to the point of compliance may have been underestimated.

Groundwater flow velocities in both the unsaturated and saturated zones beneath the proposed repository locations are sufficient that un-retarded travel times to the biosphere are only a few decades to centuries. Therefore, significant reliance is placed on the role of retardation processes to slow down radionuclide transport. These processes include both sorption and matrix diffusion. In the TSPA-LA, DOE overestimates the significance of matrix diffusion and makes inappropriate assumptions about the prevailing geochemical conditions when selecting sorption values, neglects the effects of competition for sorption sites and neglects the effects on sorption of alteration minerals formed in the rocks around the drifts. When determining distribution coefficients for use in estimating the retardation in the unsaturated zone due to sorption, DOE utilized inappropriate water types. DOE also used crushed rock samples in which enhanced absorption could have occurred on the freshly exposed mineral faces. In estimating distribution coefficients for the saturated zone, DOE relied in part on experiments in which precipitation rather than reversible sorption could have occurred and did not adequately distinguish between the dissolved and particulate-bound radionuclide components. In view of these considerations, it seems likely that DOE significantly overestimated the effectiveness of retardation for some radionuclides.

7.8 Use of inappropriate data sets and statistical methods mean that uncertainties in radionuclide transport in the biosphere and radiological impacts of released radionuclides have been substantially underestimated.

Although the biosphere model is not used directly in the NRC 2015 Draft Supplement, the soil-to-plant transfer factors and animal product transfer coefficients are used for the well pathway at Amargosa Farms, so the failure to adequately account for uncertainties in those factors identified in the Nevada safety contentions remains applicable. Although the RMEI diet is not directly relevant, similar assumptions relating to use of a restricted set of animal products apply to the dose calculations applied to the well abstraction pathway at Amargosa Farms.

7.9 Igneous intrusion probabilities and effects have been underestimated.

The igneous intrusion scenario is incorporated in the composite scenario used in the NRC 2015 Draft Supplement. Therefore, any changes in the frequency of that scenario would impact the composite TSPA source term adopted. The alternative model, in which melting of the asthenosphere implies a more active volcanic future for the Yucca Mountain area, would imply an annual probability for igneous intrusive events up to about a factor of one hundred higher than the probability adopted by DOE.

7.10 The parameter value distributions adopted in the TSPA-LA are inappropriately defined and conceptual and parametric uncertainties are not appropriately propagated through the assessment calculations.

Over and above the deficiencies in the TSPA calculations identified in previous sections, the results obtained using it should not have been adopted for use in the 2015 NRC Draft Supplement because they are not underpinned by an adequate exploration of the conceptual and parametric uncertainties and are invalidated by arbitrary and unjustified assumptions concerning the shapes of the input parameter distributions.

7.11 Groundwater Flow Paths Are Not Static and Will Rotate Clockwise As Fortymile Wash Is Activated In Wetter Climate States.

The 2015 Draft Supplement, like DOE's earlier analysis, fails to analyze a representative range of future climate conditions. The Draft Supplement notably lacks essential analysis of repository-related contamination under wetter and cooler conditions resembling those experienced fairly recently in the region's geologic history. In particular, the Draft Supplement fails to address harmful runoff in conditions resembling those experienced 26,000 years ago (26 ka), when flowing surface water at lower elevations occurred beneath stream channels, and a large lake in Death Valley was sustained by runoff from the Amargosa watershed..

A fundamental problem with DOE's saturated-zone analysis, which continues to impair analysis in the 2015 Draft Supplement, is the assumption that groundwater flow directions in future wetter climates will remain substantially unchanged from their present configuration. When recharge locations under wetter climates are not adjusted to allow recharge to occur along today's ephemeral streams, notably Fortymile Wash, the assumption holds (D'Agnese and others, 1999; Winterle, 2005). However, a large lake in Death Valley at 26 thousand years before present was sustained by runoff from the Amargosa watershed (Anderson and Wells, 2003), and the fate of transmission losses (recharge) from the Amargosa tributary network has not been evaluated. With Fortymile Wash flowing and thereby establishing the water-table elevation along its course, groundwater would flow from beneath Yucca Mountain toward the closest groundwater-discharge deposits in and south of Crater Flat. This is easily shown by a 3-point planar solution with 2 points in Fortymile Wash and one at the Crater Flat.

The amount of runoff necessary to sustain large lakes in Death Valley during recurrent cool/wet climates requires perennial, or at least seasonal, surface-water flow in Fortymile Wash. Flow of sufficient duration would overcome early transmission losses as underlying pores are saturated and aquifers recharged, allowing the water table beneath Fortymile Wash to rise to the level of the Wash but no higher. At some threshold of effective moisture, the springs south of Crater Flat will begin to flow. If this occurs, as it likely would with Fortymile Wash flowing continuously, groundwater flow directions beneath Yucca Mountain are re-directed from southeast to southwest based on the 3-point solution presented in Timbisha contention TIM-NEPA-004.

Though purporting to evaluate environmental impacts associated with discharge of any contaminated groundwater to the ground surface, the 2015 Draft Supplement builds upon a flawed conceptual model of recharge under wet-climate conditions. Recharge locations are in

error since focused recharge in the basins (Stonestrom and others, 2007) is not considered, and groundwater flow paths derived by particle-tracking are in error, and subsequent calculation of flow and transport in “tubes” aligned with flow paths are without merit since the paths are incorrect. The Death Valley Regional Flow System (DVRFS) model (Belcher and Sweetkind, 2010) is an evolving and adequate model of present-day conditions but ill-suited for modeling the wetter climates that have produced significant runoff and recharge along the Amargosa River and Fortymile Wash unless numerous “drain” cells in the model are re-defined as “river” cells and supplied with recharge (river losses). Recharge along the presently ephemeral stream channels equates to transmission loss from the runoff required to sustain a large lake in Death Valley, such as that at 26 ka, and the DVRFS model is not configured to accept these transmission losses. All derivative models of groundwater flow and radionuclide transport are therefore invalid because they inherited erroneous boundary conditions from the regional model.

The amount of runoff required to sustain a 350 square mile lake that existed at 26 ka in Death Valley is the amount required to balance evaporation from the lake; geologic evidence indicates this 90-m-deep lake was sustained almost entirely by the Amargosa River (Anderson and Wells, 2003). Perennial or sustained seasonal flow in the Amargosa would constitute an environment of focused recharge beneath the Amargosa and its tributaries, notably Fortymile Wash. The spatial distribution of recharge would have been very different than the largely elevation-controlled pattern described by the Maxey-Eakin method and its variants.

NRC has not considered that a regional, watershed-based net-infiltration model (Hevesi and others, 2003) should have been coupled with an appropriately-modified regional groundwater model (Belcher and Sweetkind, 2010) to provide a deterministic recharge estimator. A simple 3-point problem, illustrated in TIM-NEPA-004, shows that with Fortymile Wash running full and groundwater discharging in southernmost Crater Flat the specific discharge vector in the saturated zone beneath Yucca Mountain is directed southwestward.

Correcting this deficiency must occur before any further action, if any, is taken to approve and implement the proposed action. That conclusion is compelled both by respect for sound science and because it is legally necessary. NEPA requires that "environmental issues be considered at every important stage in the decision making process concerning a particular action." (*Calvert Cliffs' Coordinating Commission, Inc. v. Atomic Energy Commission*, 449 F.2d 1109, 1118 (D.C. Cir. 1971); *New York v. Nuclear Regulatory Commission*, 681 F.3d 471, 476 (D.C. Cir. 2012)(quoting *Calvert Cliffs'*.) Federal agencies reviewing a proposed action “shall insure the professional integrity, including scientific integrity, of the discussions and analyses in environmental impact statements. They shall identify any methodologies used and shall make explicit reference by footnote to the scientific and other sources relied upon for conclusions in the statement.” (40 C.F.R. 1502.24.)

Rigorous adherence to scientific integrity and transparent explanation of methodologies are particularly crucial to ensure NEPA compliance for proposed actions addressing nuclear waste, due to its “dangerous, long-term health and environmental risk.” (*New York v. Nuclear Regulatory Commission*, 681 F.3d 471 (D.C. Cir. 2012)) NEPA requires analysis of the full range of climate conditions and water use circumstances that may arise in the areas affected over

the million-year period studied. Analyzing project impacts in the affected areas under a sufficiently broad range of potential climatic and hydrologic conditions is essential to properly understand the role of “context” and “intensity,” as NEPA guidelines require for the significance determination. (40 C.F.R. § 1508.27.) Studying an unlawfully truncated range of conditions here would amount to placing a risky bet against the affected region’s own geologic history—namely, that physical conditions over the next million years will not resemble ones potentially more prone to radiation exposure that existed just 26,000 years ago.

The potential for major long-term groundwater and surface discharge impacts in the Death Valley area, particularly under wetter and cooler conditions, also underscores the need for analysis of project operation under California law, and the potential for conflict with laws protecting water rights and water quality, and those addressing the sustainable management of groundwater. (See, e.g., California Wat. Code, §§ 13000, *et. seq.* (Porter-Cologne Water Quality Act); Cal. Const., art. X, § 2 (“[t]he right to water or to the use or flow of water in or from any natural stream or water course in this state is and shall be limited to such water as shall be reasonably required for the beneficial use to be served, and such right does not and shall not extend to the waste or unreasonable use or unreasonable method of use or unreasonable method of diversion of water”); *Baldwin v. County of Tehama*, 31 Cal. App. 4th 166 (1994)(upholding county groundwater ordinance); *National Audubon Society v. Superior Court*, 33 Cal.3d 419 (1983) (public trust doctrine); California Wat. Code, §§ 10720, *et. seq.* (Sustainable Groundwater Management Act of 2014). However, the 2015 Draft Supplement provides no such analysis.

7.12 The 2015 Draft Supplement Evaluation of Radionuclide Accumulation and Criticality Risks is Fatally Flawed.

The uranyl-vanadate mineral carnotite is absent from all thermodynamic databases referenced in DOE’s Yucca Mountain Project literature, including those utilized for In-Drift Precipitation/Salt (IDPS), Near-Field Chemistry (NFC), and the supplemental study of vanadium solubility and release to the biosphere (Lester, 2009). It was recognized as early as 1997 that “...the possibility for (Yeelirrie-) type of ore deposit to form is unlikely due to the fact that there is no known source of vanadium in the area that is required to precipitate carnotite. However, due to the fact that Franklin Lakes (*sic*) playa is the currently expected location for surficial discharge of groundwaters flowing beneath Yucca Mountain..., one could expect some accumulation of uranium mineralization via the same evaporative mechanisms that have formed the playa” (CRWMS M&O (1997, p. 62)). Basaltic rocks were apparently unrecognized as a substantial source of vanadium, and the issue was not revisited when a new source, Alloy-22, was introduced. There are serious, unaddressed issues of potential criticality if deposits of carnotite form anywhere in or downgradient of the repository.

Aqueous models (thermodynamic databases) used to develop source terms (mobilization rates over time) for the possible contaminants originating in the repository are deficient yet are presented without the caveats that would describe the huge uncertainties associated with predicting solution-mineral (and solution - non-mineral solid) interactions in complex systems.

The chemical evolution of groundwater in the repository environment will be dominated by cyclic evaporation and condensation at elevated temperatures, followed by re-wetting as the repository cools and development of a carrier plume (if a flow system is established through one or more drifts) in which the evolving signature of the repository is impressed on that flow system. SNL (2007a) has developed an In-Drift Precipitation/Salt (IDPS) model based on the EQ3/6 code and updated Pitzer interaction coefficients for the system Na-K-H-Mg-Ca-Al-Cl-F-NO₃-SO₄-Br-CO₃-SiO₂-CO₂-O₂-H₂O between 20⁰C and 40⁰C, and validated the model using experimental evaporation data from J-13 water, pore water, and seawater.

The IDPS model (SNL, 2007a) is a process-level model of solution-mineral equilibria, intended to support evaluations of the performance of the engineered barrier system (SNL, 2007b). The latter document, in turn, applies EQ3/6 to provide pH, chloride, and nitrate concentrations to “*General Corrosion and Localized Corrosion of Waste Package Outer Barrier*” via a near-field chemistry (NFC) model. In this model a single alkali feldspar composition is adopted (SNL, 2007b, p. 6-32) despite evidence that distinct K-rich (sanidine) and Na-rich (anorthoclase) phases are present. Potassium and silica will be added to repository waters as sanidine alters to kaolinite, with silica re-precipitating and dissolved K⁺ subject to exchange reactions but still generally available for carnotite formation whether or not it is weakly sorbed to clays or other substrates.

The IDPS model is generally successful at predicting major-ion evaporating water compositions when precipitation of certain mineral phases is subjectively suppressed. The IDPS model does not account for dissolved uranium or vanadium species so the possible precipitation of carnotite is, in effect, suppressed. Significantly, the huge External Accumulation report (BSC, 2006) contains not a single instance of the words carnotite or vanadium. Because of this, it appears that carnotite may be absent from all of the Yucca Mountain Project's considerations, though it would certainly form to some finite extent in association with a degrading repository at Yucca Mountain.

Repository heat would enhance evaporation rates and complicate geochemical modeling analyses of the near-field environment for thousands of years. Otherwise, evaporation at ambient temperatures in groundwater discharge areas is analyzed with the same aqueous models summarized by Wolery and Sutton (2011). It is well-established from years of study by numerous investigators that the early precipitation of relatively insoluble minerals, notably carbonates and gypsum, is a fundamental process that controls evaporative brine evolution (Li and others, 1997, p. 1362 and references therein). Brines will develop as repository heat causes water to evaporate, and from evapotranspiration in groundwater discharge areas. Chemical divide theory provides the technical basis for a general understanding of brine evolution (Farmer and others, 2003), and suggests that most seepage water entering the repository will evolve to chloride-sulfate or bicarbonate brines, while a much smaller proportion will evolve to more aggressive calcium chloride brines (Figures 7.12.1 and 7.12.2).

DOE, and the NRC Staff in the 2015 Draft Supplement, have not evaluated the importance of environmental vanadium in controlling dissolved uranium concentrations in groundwater. The vanadium-bearing uranium minerals carnotite and tyuyamunite are absent from the most recent

Project thermodynamic databases (Wolery and Sutton, 2011) and therefore suppressed by omission. Worldwide, high concentrations of vanadium are often found in groundwaters associated with basalt (Wright and Belitz, 2010; Terada and Naotatsu, 2011). It was not until Alloy-22 gained acceptance that vanadium was even considered as a potential contaminant, but never has it been comprehensively evaluated in terms of environmental sources in the Yucca Mountain region. Potential interactions with uranium when they co-exist in solution can include mineral precipitation. The aqueous geochemistry of vanadium is far more complex than the simple, sorption-dominated DOE/NRC treatment, whether on the process-model or abstracted levels of analysis (Wright and others, 2014).

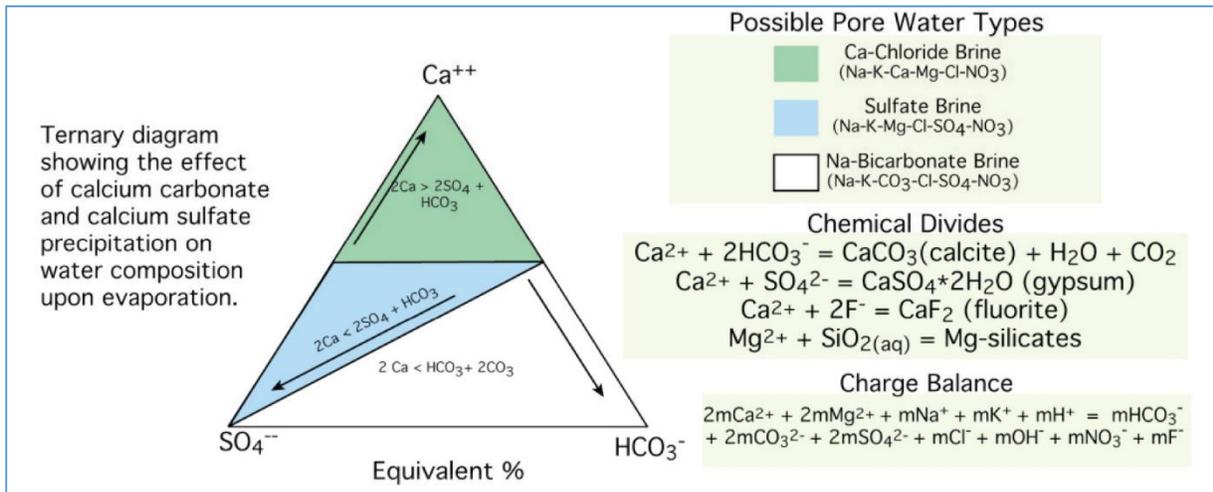


Figure 7.12.1. Conceptual representation of the Conceptual Divide Theory (Farmer and others, 2003)

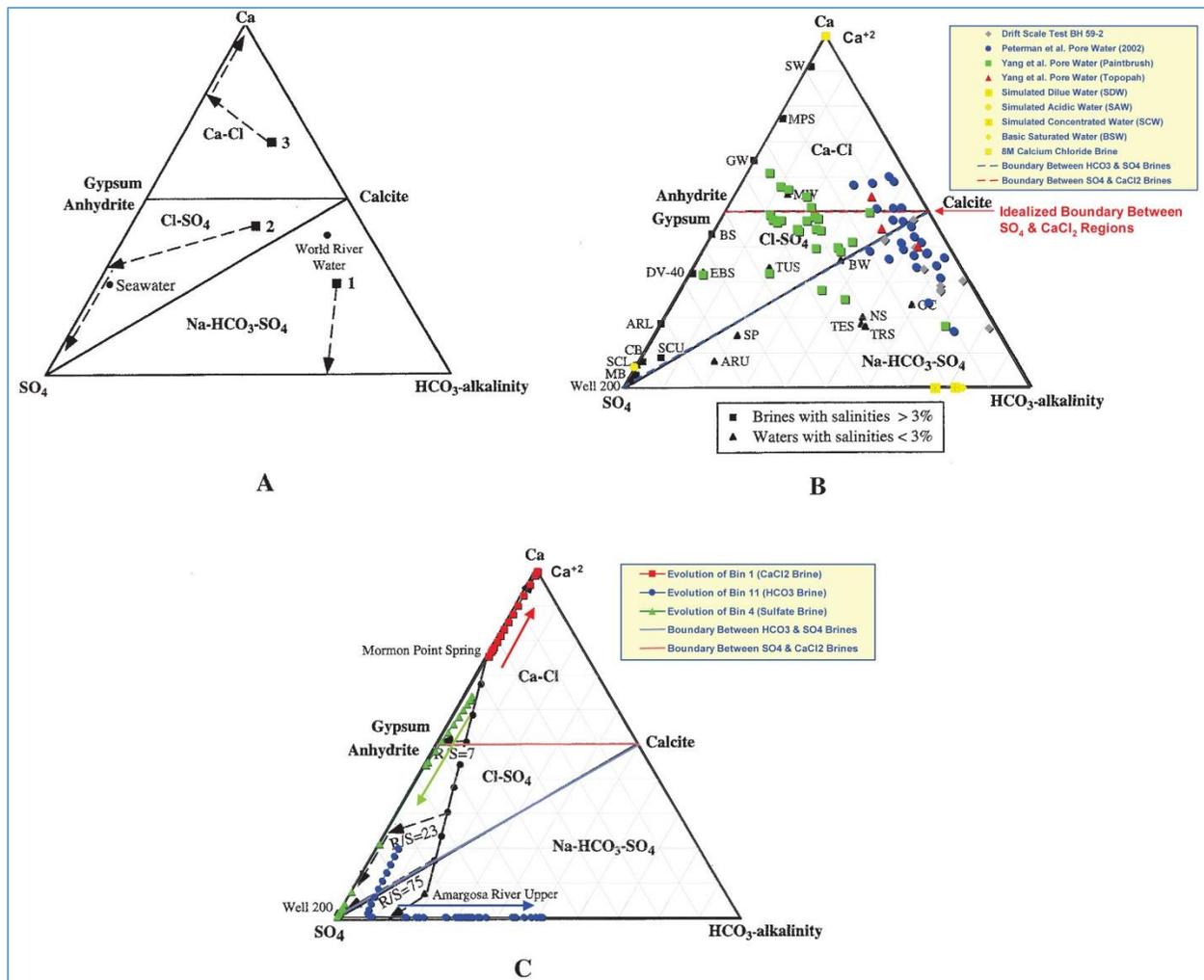


Figure 7.12.2. Colored symbols are overlay of observed pore water compositions (B) and evaporation trends (C) on chemical divide diagrams with samples from Death Valley (B) and evaporation trend for mixtures of Amargosa River and Mormon Point Spring waters. R/S represents river/spring volume fraction. Base diagram from Li and others (1997), overlay from Farmer and others (2003).

Vanadium is present in the Alloy-22 anti-corrosion barrier at the 0.35 weight-percent level, giving 190,000 kg of vanadium in the base-case (70,000 MTHM) repository (Lester, 2009c, p. 24). Somewhat puzzling is the 4.8 mg/l (4,800 $\mu\text{g}/\text{dm}^3$) source concentration based on Alloy-22 corrosion simulated with EQ3/6; this is as high as some vanadium-contaminated groundwaters at New Rifle, Colorado (DOE, 2010). The report by Giles (1978) gives dissolved concentrations of uranium (2.5-1,200 $\mu\text{g}/\text{dm}^3$) and vanadium (10-130 $\mu\text{g}/\text{dm}^3$) in the vicinity of the Yeelirrie (Australia) orebody.

Product phases that are predicted to form as J-13 water is titrated with Alloy-22 are not identified by Lester (2009c). The overall simulation as described by Lester (2009c, p. 25) is a rational but imaginative construct, purporting to illustrate the chemical evolution of groundwater that dissolves Alloy-22 and then “percolates through” the tuff environment. Neither the conceptual

model for dissolution of metal or the “Fluid-Centered Flow – Through Open System” used by M&O (1997) and adopted by Lester (2009c) for subsequent reactions in the tuff environment are necessarily accurate or unique, and are therefore non-conservative since the alternatives are unknown. Stoichiometrically, the inventory of Alloy-22 could release enough vanadium to form 2,913 metric tons of carnotite, $K_2(UO_2)_2(VO_4)_2 \cdot 3H_2O$, that would contain over 1,500 metric tons of generally fuel-grade uranium. DOE, and now NRC in the Draft Supplement, have failed to explore the range of possible interactions between uranium in the waste forms and vanadium in the corrosion barrier that might enhance the possibility of carnotite accumulations in the repository, aquifers, and accessible environment similar to natural occurrences in southern Nevada (Johnson, 1982) and at Yeelirrie (Arakel, 1988).

Given a pluvial-state groundwater flow field, which DOE has failed to compute in a credible fashion, mineral precipitation in groundwater-discharge areas needs to be evaluated in terms of reaction progress (Johnson, 1982) and not treated as if sorption and evaporation of dilute waters to dryness without chromatographic effects were the only accumulation processes that could occur in those areas. Notably, all geochemical model reports examined to date are silent on how and where the mineral carnotite might precipitate, including in the near-field environment. Source term calculations are therefore now suspect and criticality concerns are raised as a result of this review.

There is no evidence that carnotite, $K_2(UO_2)_2(VO_4)_2 \cdot 3H_2O$ or tyuyamunite, $Ca(UO_2)_2(VO_4)_2 \cdot 3H_2O$ have received consideration as potentially-significant components of the repository, aquifer, and accessible environments around Yucca Mountain. Guillaumont and others (2003, p. 549) consider Langmuir’s (1978, 1997) derivation of the free energies of formation of these minerals, derived from the solubility studies of Hostetler and Garrels (1962), “rather speculative”. The Guillaumont review “does not select” solubility data for these vanadate minerals, although “they can be used as guidance”. Johnson (1982) utilized Langmuir’s carnotite data in a simulation of evaporating Las Vegas Valley groundwater, obtaining results consistent with paragenetic relations observed in calcrete veins and outcrops in the region (carnotite generally precipitates after gypsum, which follows calcite).

With U, V, and carnotite outside the defined chemical systems of the IDPS or NFE evaporation models, carnotite equilibria are not considered although this U- and V-bearing mineral is likely to precipitate as containers are breached, particularly if contacting waters have evolved to high- K^+ , low HCO_3^- compositions. Natural analogues where carnotite has precipitated from evaporating groundwater, calcrete uranium deposits, exist in Australia and elsewhere.

SNL (2009, p. 62) indicates that similar sorption (distribution) coefficients apply for uranium and vanadium, so absent independent solubility controls U and V would migrate similarly after release from the repository. Due to the close proximity of U and V sources and great excess of U in the repository environment, it is possible that most or all V released by corrosion would be re-deposited in-situ as carnotite as adjacent fuel is exposed. The inventory of carnotite will be partially dissolved intermittently, with U and V flushed to and fro within and from the repository and periodically re-precipitated as hydrologic conditions change, consistent with the findings of disequilibrium studies at Yeelirrie (Dickson and Fisher, 1980) that show significant and ongoing

remobilization of uranium there. Determinations need to be made as to how large would an accumulation of carnotite would be needed to be to pose a criticality issue and what would be the limiting volumetric threshold be below which criticality could not pose a risk. Evaluations of the manner in which doses would be acquired by an individual living in a zone of evaporating groundwater discharge with carnotite precipitating, similar to Yeelirrie in Australia should be performed

The reason for DOE's (and subsequently NRC's) silence on carnotite as a mineral phase that is important to waste isolation is revealed in BSC (2005, p. IV-21). In reference to natural analogues that were studied to establish alteration mineral assemblages, DOE found that (with the exception of Peña Blanca) "...the mineralogy of the uraninite alteration is significantly affected by the presence of *chemical elements not found at Yucca Mountain* (e.g. lead, phosphorus, or vanadium)". Contrary to this statement, sources of vanadium exist in Alloy-22 and mafic rocks of the area, and vanadium is represented in numerous analyses of groundwater from the Yucca Mountain area (Rose and others, 2006; Telfeyan and others, 2015). In fact, BSC (2005, p. 6-26) contains the internally-contradictory statement that "Other elements expected to be present in potentially significant amounts within the waste package or the invert are lithium, boron, aluminum, titanium, chromium, manganese, iron, nickel, zirconium, hafnium, and possibly vanadium, cobalt, niobium, molybdenum, and tungsten". Interestingly, BSC (2007), a revision of BSC (2005), contains no mention whatsoever of carnotite.

By overlooking Yeelirrie, Australia as a natural analogue and failing to recognize the ubiquity of vanadium as a trace element in Yucca Mountain groundwater DOE has made a serious error of omission in their characterization of engineered barrier system (EBS) chemistry. The result is that a representative suite of transport and accumulation scenarios that includes carnotite has not been evaluated. Critical or sub-critical accumulations of fuel-grade uranium as carnotite are of concern throughout the groundwater system, from repository to discharge locations. It is not inconceivable that an individual could reside near such an accumulation.

With a nominal footprint of about 1,250 acres (DOE, 2008, p. 1-11) and an assumed lognormal distribution of deep percolation rates truncated at 10 and 100 mm/year (10 CFR 63.342), area-average fluxes through the repository footprint are constrained by regulation to lie between 41 and 410 acre-ft/year (50,500 to 505,000 m³/year). If dissolved uranium is present at concentrations of 1 mg/l in repository effluent, removal of U from the repository will occur at rates between 50 and 500 kg/year. With an inventory of 70,000 MTHM, 1.4 x 10⁶ years would be required to mobilize the full uranium inventory at the lower-bound percolation rate, and 1.4 x 10⁵ years at the higher rate.

Nature offers an infinite variety of aquifer porosity fields within which uranium and other mobile radionuclides could precipitate as mineral solids or be filtered from colloidal suspensions, forming high concentrations within the pores in both cases. The interconnected porosity between the repository and the accessible environment can vary from 100% (within the mined openings of the repository) to effectively zero in unfractured zones between the intermediate-porosity groundwater flow paths. Recent evaluations of anomalous criticality conditions, the low concentrations at which criticality can occur, and the effects of water mists as moderators

(Clayton, 2010) gives credence to a realm of accumulation scenarios that DOE/NRC have dismissed in cavalier fashion.

A range of ^{235}U densities required for criticality in infinite slabs, infinite cylinders, and finite spheres of uranium blended with silicious soil was presented by (Toran and others, 1997, pp. 96-100). Hand calculations show that at 4% enrichment, carnotite would contain about 0.1 g $^{235}\text{U}/\text{cm}^3$. Criticality can occur at ^{235}U concentrations as low as 0.0014179 g/cm³, two orders of magnitude less and requiring porosities only in the 1-2% range. The dose consequences of a criticality event could be severe, even in the case where vaporization of soil moisture “shuts down” the criticality (Toran and others, 1997, p. 72).

What is the maximum likely uranium concentration that would be attained after dissolution of fuel materials in waste packages? Lester (2009, p. 33) explains that an EQ3/6 screening effort produced very small values of uranium concentration that DOE chose to ignore as a matter of policy, given the large bulk quantity of uranium in the repository. DOE derived an estimate of uranium solubility as $\text{UO}_2(\text{OH})_2$ using relations from TRW Environmental Safety Systems Inc. (TRW) (1997) with pCO_2 (10^{-3} atm) and pH (8) from the Viability Assessment; the result is 0.6 mg/l, close to uranium concentrations in groundwater associated with the Yeelirrie orebody (Giles, 1978, p. 35). These concentrations are achieved in the presence of carnotite. Note that dissolved vanadium in the ore zone does not exceed 130 $\mu\text{g}/\text{l}$ (Giles, 1978, p. 33).

Exposure of waste package contents and solids reorganization

Water will drip, cyclic wetting and drying will occur, and the limiting case of saturation is clearly and conservatively the flooded repository. The waste containers and their decomposition products will be exposed over time to the widest possible range of moisture conditions. Release of silica from feldspar and glass alteration driven by the repository hydrothermal system will produce floor sealing and therefore perching of percolation (flooding) during cooldown from boiling temperatures. Water table rise in the distant future under cool/wet climates with abundant surface water and more nominal thermal conditions in the near-field environment will subject the repository to a groundwater flow field, sweeping heat and mass away in accordance with wet climate boundary conditions (recharge in Fortymile Wash).

TRW (1997, p. iv-vii) assumed congruent dissolution of a plutonium-bearing glass and ceramic waste forms and performed bounding calculations of the amount of fissile material (uranium, plutonium, and gadolinium) trapped in the invert. A number of cases were identified with concentrations that could produce criticality, prompting the authors to recommend reducing plutonium loading and addition of depleted uranium. “External” criticality was to be dealt with in a future report. TRW (1997) assumed infiltration of 1 to 10 mm/year, far less than current estimates of 10-100 mm/year, which would lessen the tendency for gadolinium to accumulate in a compact mass at the bottom of the container. Stratification of fissile materials in clayey masses of degradation products could produce worse cases than those analyzed in detail by TRW (1997).

DOE’s near-field geochemistry analyses have been non-conservative due to the suppression of uranium minerals as void-filling phases, causing site-specific criticality assessment (a successor activity) to suffer from the implicit assumption that no mineral grade concentrations of

radionuclides will ever form in the repository. In the 2015 Draft Supplement, precipitation of uranium minerals is similarly suppressed when considering groundwater discharge areas. Short-lived fission products arising from a surficial criticality event present a noteworthy dose mechanism.

It would be irresponsible to not consider intermittent flooding of the repository as an integral part of any conservative accumulation scenario. The frequency and duration of flooding events then become important variables to consider as controls on corrosion processes and therefore the source term for transport and release scenarios.

Consideration of criticality in infinite-length cylinders is certainly appropriate, since horizontal emplacement as currently envisioned would eventually produce linear piles of decomposition products along the tunnel alignments that would approximate infinite cylinders. Small-scale erosion and deposition of particulate materials along the linear mined openings will occur, typical of the sedimentary processes on the floors and in the “piss ditches” of tunnels worldwide. Clayton (2010, p. 166) notes that no single isotope of ^{233}U , ^{235}U and ^{239}Pu is observed to have the smallest critical concentration over all possible (infinite) cylinder diameters, so a system proved to be safe by geometry for one of these three isotopes would not necessarily be safe for either of the other two. Notably, criticality data are generally lacking for slightly enriched uranium fuel rods greater than about 2 inches in diameter (Clayton, 2010, p. 42). Worse, experimental data on critical configurations do not exist for any of the actinide nuclides other than ^{242}Pu , ^{233}U , ^{235}U and ^{239}Pu (Clayton, 2010, pp. 30 and 96). Classification of tens of significant actinide nuclides in terms of critical mass is therefore conjectural at this point in time.

Ore-forming processes along groundwater flow paths

The Office of Civilian Radioactive Waste Management Managing and Operating (OCRWM M&O) (1997) identified 3 categories of uranium deposit (unconformity, sandstone, and calcrete) that might be considered natural analogues for future radionuclide accumulations originating from the waste inventory at Yucca Mountain. The first 2 types require electrochemical reduction of dissolved U(VI) to U(IV) and consequent precipitation of U(IV) minerals; the latter requires a source of dissolved vanadium and evaporation from the phreatic zone to precipitate carnotite, a U(VI) mineral. Reducing environments are widespread in paludal deposits of the region, preserved as “black mats” in the marsh and wet meadow environments represented there (Quade and others, 1998). Evaporation is characteristic of groundwater discharge, and vanadium is abundantly available in Alloy-22, basaltic rocks, and groundwater contrary to the assumptions of CRWMS M&O (1997). Explicit and implicit suppression of uranium mineral precipitation in geochemical models from CRWMS M&O (1997) to Lester (2009c) guarantee that highly concentrated radionuclide accumulations in the void spaces of the aquifers or at the surface of a wetted discharge area will not be simulated. DOE and NRC prefer to take credit for sorption, dilution, and dispersion to reduce the concentrations of solutes of interest, but do not allow reconcentration to occur as geochemical divides are crossed and groundwater flow paths converge toward groundwater sinks (points of discharge).

7.13 The 2015 Draft Supplement Ignores Plausible Dose Mechanisms in Groundwater Discharge Areas.

If carnotite precipitates in groundwater discharge areas there will be ingestion, inhalation, and external exposure pathways that have not been evaluated. NRC could measure potential exposures in the field using the Yeelirrie analogue, an investigation that could be easily accomplished in cooperation with the Australian Nuclear Science and Technology Organization. Theoretical calculations of doses that might accompany a Yeelirrie deposit with an isotopic composition representative of spent fuel composition in the distant future are warranted but not available in the 2015 Draft Supplement.

Biosphere pathways were also not fully investigated in NRC's 2015 Draft Supplement. Most notably, chromatographic effects as solutes are removed from solution and deposited by sequential precipitation during evaporation or electrochemical reduction were not considered. Deposits of carnotite at Yeelirrie and elsewhere including southern Nevada attest to evaporation as an enrichment mechanism for uranium that can and does accumulate at land surface.

Garrick (2008), during his term as Chairman of the Nuclear Waste Technical Review Board (NWTRB), recognizes the source term as possibly the most critical aspect of the performance of a repository, and that "Determining the source term is a difficult technical and scientific problem that requires supporting research and development not incorporated in DOE's current model". Garrick (2008) notes that the physical chemistries of important dose-contributing radionuclides are known only from laboratory experiments designed to assess behavior in engineered systems designed for separation and recovery, not in complex natural environments containing minerals and alteration products. The NWTRB had continuing concerns about localized corrosion due to deliquescence at elevated temperatures, since the surface temperature of the waste packages would quickly increase to as high as 210°C and will not fall below 100°C for about 1,000 years (Garrick, 2008, pp. 3-4). "...DOE has little data on corrosion at temperatures above 100°C and even less corrosion data at temperatures above 150°C".

The calculation package by Lester (2009c) makes little sense in terms of meaningful characterization of dissolving steel and reacting tuff, in particular the way concentrations of uranium and vanadium are assigned and then modeled. The assumed vanadium source concentration (4.8 mg/l) exceeds all but the highest values observed in nature (DOE, 2010). Dissolved vanadium concentrations would be solubility-limited if present in mg/l concentrations in the presence of dissolved uranium, but it is known from the Project literature that because concentrations of U and V were not incorporated at least one important solubility-controlling mineral phase was suppressed in analyses of the geochemical environment of the repository. In the presence of uranium at mg/l levels, the dissolved concentration of vanadium would be maintained at a much lower value than is assumed as carnotite precipitates. The report by Giles (1978) gives groundwater analyses from in and around the Yeelirrie U+V deposit where carnotite is in contact with groundwater at pH in the 7-8 range, TDS up to 28,790 mg/l in water-quality profiles where salinities increase in the downward direction, and temperatures near 25°C (Giles, 1978, p. 34-35). Geochemical modeling of the distribution of dissolved species in Yeelirrie waters would generally *not* require Pitzer specific interaction coefficients, since most

salinities are less than those of seawater. Modeling solution-mineral equilibria in Yeelirrie groundwater and evaporation of the more dilute examples to test for carnotite precipitation would be an important validation test of the Project's thermodynamic database cited by Lester (2009, p. 2112).

7.14 Conclusion

For all the reasons noted in this comment, results from the TSPA-LA cannot be used as input to the 2015 Draft Supplement, and the current Draft Supplement's reliance on them discredits the basis for its rejection of significant impacts. The 2015 Draft Supplement focuses on the radiological impacts of the groundwater pathway and, as such, it needs to rely on an appropriate evaluation of the groundwater flow regime. For infiltration through the unsaturated zone, complete reliance is placed on the flawed DOE analysis presented in the License Application.

Specifically, the Draft Supplement fails to recognize that infiltration rates could be much larger than estimated by DOE, both because of climate conditions outside the range considered by DOE (comment 7.1) and because of gross deficiencies in the MASSIF infiltration model (comment 7.3). Furthermore, erosional incision could facilitate future increases in infiltration, as well as eventually resulting in exhumation of the proposed repository (comment 7.2). Increased infiltration means that more water is available to degrade the engineered barrier system of the repository.

Not only is more water expected to infiltrate into the unsaturated zone above the proposed repository horizon, it is also expected to percolate downward much more effectively than is assumed by DOE. DOE, and NRC Staff in relying on its earlier analysis, have grossly underestimated the potential combined effects of extreme infiltration events and fast flow pathways that are able to conduct the water rapidly to depth (comment 7.4). Thus, both the temporal and spatial pattern of water flows at the repository horizon as well as the total amount of flow are expected to be substantially different from those assumed by DOE, particularly when the complexities of coupled thermo-hydro-mechanical-chemical effects and multi-phase flow are taken into account (comment 7.5).

Detailed analyses undertaken by Nevada show that there are many ways in which the proposed engineered barrier system can fail (comment 7.6). In particular, the drip shields may never be emplaced, may be improperly installed or may fail mechanically, e.g., as a result of rock falls, with the likelihood of failure being increased by fabrication difficulties or errors.

Even if the drip shields and waste packages are emplaced as intended, they are likely to be subject to much more rapid and intense corrosive degradation than is postulated in the existing analysis. Indeed, because DOE and NRC have not studied the relevant range of water types and corrosion regimes, enhancements in corrosion rates cannot readily be bounded, such that radionuclide releases from the waste packages are likely to be larger and occur earlier than is presently postulated. On these grounds alone, the source term at the point of compliance would be much larger than that adopted in the Draft Supplement. However, as sorption to the rocks of the unsaturated and saturated zones seems also to have been overestimated by DOE (comment

7.7), it seems likely that radionuclide fluxes at the point of compliance would be further increased.

There are also computational reasons why those fluxes are likely to have been incorrectly estimated. This arises from problems with the definition of parameter value distributions in the TSPA-LA and a failure to propagate a full range of conceptual and parametric uncertainties through the assessment calculations. It is not clear whether mean radionuclide fluxes at the point of compliance would be increased or decreased if these matters were properly addressed, but it is clear that the range of uncertainty in those fluxes would be increased. It is emphasized that a deficiency of the NRC Draft Supplement is that it uses only point value estimates of radionuclide fluxes at the point of compliance and does not consider uncertainties in those fluxes.

Finally, the fluxes at the point of compliance are used to estimate radionuclide concentrations in abstracted well water further downstream at Amargosa Farms. Those radionuclide concentrations are used to calculate doses to humans on the same basis as was used by DOE (and assumed in the 2015 Draft Supplement) to estimate the dose to the reasonably maximally exposed individual (RMEI) at the point of compliance. Thus, the deficiencies noted in the calculations of dose to the RMEI also apply to users of well water at Amargosa Farms (comment 7.8).

In summary, because of the errors and deficiencies noted above, no reliance should be placed by NRC on outputs from DOE's TSPA-LA in the 2015 Draft Supplement. Rather, a cautious, simplified source term, as used for non-radioactive contaminants, should be employed.

COMMENT 8.0

THE 2015 DRAFT SUPPLEMENT IMPROPERLY RELIES UPON “AVERAGE CLIMATE”, A CONSTRUCT THAT PERMITS MISCALCULATION OF DOSE

No comprehensive or credible analysis supports the idea in the 2015 Draft Supplement, apparently extrapolated from 10 CFR Part 63, that “average” net infiltration produces valid estimates of radionuclide release rates or locations. Part 63 does not constrain the NEPA impact analysis. Many concerns about NRC’s Draft Supplement revolve around inadequate treatment of the complexities generated by climate-induced changes in hydrology. Of course, the assumption of steady-state conditions over the assumed 990,000 years of “geologic stability” vastly simplifies performance assessment, but the approach is scientifically unsupported and improperly limits the analysis of Yucca Mountain’s long-term impacts. Notwithstanding “average-climate” performance assessments, any waste isolation provided by the Alloy-22 barrier is unclear, given the potential for accelerated corrosion in uncertain hydrothermal environments from climate instability created by current global warming. The geologic record clearly shows that periods of salt accumulation in the repository will alternate with periods of flushing during wetter climates, with discharge locations different from present locations.

There is no such thing as “average” climate, and modeling of 990,000 years of future hydrology as if conditions are unchanging is a misguided exercise. Evaporation cycles followed by wetting and flushing of the aquifer on time scales much longer than the time required for contaminants to

transit the flow system would cause arrival spikes at the discharge area. Doses received during the small fraction of total elapsed time when pulses of contaminated water reach the biosphere would greatly exceed the average doses.

Perhaps NRC needs to better distinguish between the terms *infiltration* and *climate*, which have been conflated by rulemaking (10 CFR 63.342(c)(2), a circumstance that cannot lawfully support failure to analyze potentially significant impacts here. The prescribed distribution and average of infiltration rates may not be realistic, could be sustained by a range of temperature/precipitation combinations, and should be cross-checked with regional water balance for validation of the legislated infiltration rates which NRC itself prescribed. Performance assessments sample from a specified distribution of infiltration (percolation) values through the repository but it should be recognized that there is a spectrum of temperature/precipitation pairs (Figure 8.1) that could produce the assumed infiltration.

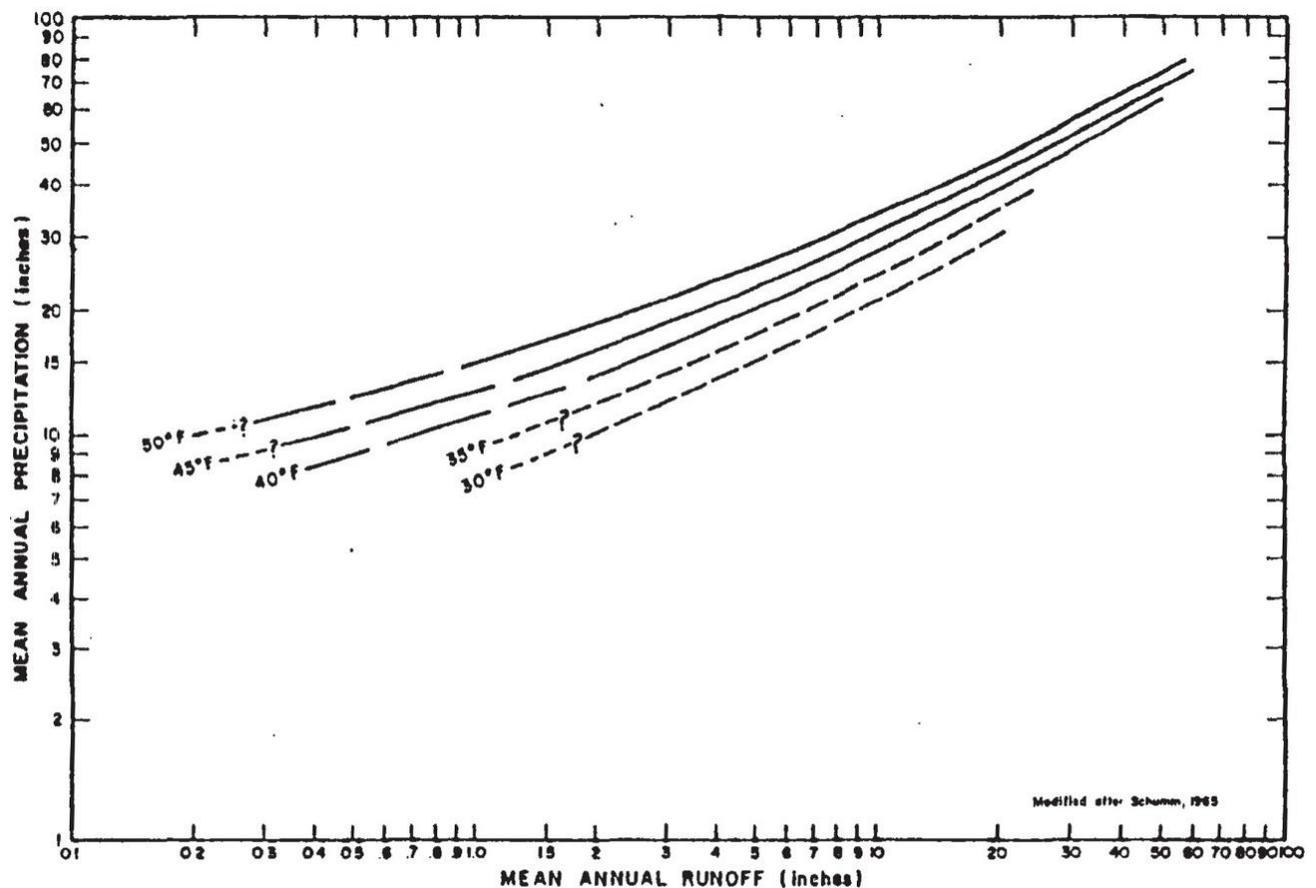


Figure 8.1. Relation between weighted mean annual temperature, precipitation and runoff (modified after Mifflin and Wheat, 1979). Presented to NWTRB by M.D. Mifflin, April 21, 1993.

A distribution of possible runoff conditions (due to uncertain precipitation) should force consideration of several saturated-zone (SZ) flow fields, each corresponding to a precipitation rate applied to the net-infiltration model and therein transformed to infiltration and runoff and exported to the groundwater model as “river” losses. Some paths within the set of flow fields determined this way would be more consequential than others, and would not be known from

present conditions or scaled derivatives of present conditions as the Draft Supplement appears to have assumed. Climate is implicit in each realization of the TSPA chain of analyses. Beginning with the selection of a single value from a net-infiltration distribution, the DVRFS model should produce a unique groundwater flow field as water is allowed to recharge along Fortymile Wash. Mass balance in the DVRFS model must be consistent with and constrained by the size of any corresponding lake in Death Valley. The sedimentary record there and at Devils Hole provide tests of water balance and paleotemperature.

From Mifflin (1993), effective moisture is that part of the basin hydrologic budget that escapes direct evaporation or evapotranspiration in the catchment basin and reaches the hydrologic sink(s) of the basin. In the semi-arid and arid basins of the Great Basin, effective moisture is most readily quantified at the groundwater discharge areas and surface water sinks in the bolsons. Mifflin makes the important point that “Penepluvial effective moisture, because of the widespread regional paleohydrologic evidence and hydrographically closed basin hydrology, may prove to be quantitatively more tractable than the attempts being made to quantify present net recharge at Yucca Mountain”. A watershed-scale net infiltration model (Hevesi and others, 2003) coupled with a regional groundwater model capable of capturing focused recharge effects along presently ephemeral streams will be needed to associate net infiltration beneath the repository with the *range* of climates that could produce it.

“Average” infiltration will not produce flow paths that are representative of extreme climates; what if 90% of recharge occurs in 10% of the time? Those important flow paths are missed.

Progress toward a capability to describe “climate” or “effective moisture” in terms of fundamental and measurable parameters (precipitation and temperature) is needed. Precipitation is the fundamental process variable for radionuclide transport model development, calibration, and cross-checking against geologic evidence of runoff (lakes) and regulatory prescription (10 CFR 63.342) for reasonableness. Since groundwater flow pathways are sensitive to where recharge is input, “total system” assessments should honor water balances in the overall Death Valley hydrologic system where recharge approximates discharge and treat as reasonable and conservative those cases showing transport between Yucca Mountain and the southern Crater Flat area. This would be the case with perennial flow in Fortymile Wash and discharge at the Crater Flat paleospring deposits.

COMMENT 9.0

NRC’S 2015 DRAFT SUPPLEMENT IMPROPERLY PRESENTS IMPACTS IN TERMS OF RISK, RATHER THAN DOSE.

The 2015 Draft Supplement’s use of DOE’s TSPA mean radionuclide flux at the point of compliance as the source term for human radiation exposure calculations resulting from groundwater contamination and discharges of contaminated groundwater provides a result that represents calculated risk rather than actual potential doses.

The TSPA model is a probabilistic tool that models uncertainty and variability in many parameters, including the effects of future climate change. The TSPA model also includes

probability-weighted scenario classes, which represent different events or processes that can cause failure of the engineered barriers (such as drip shields or waste packages) and cause the release of contaminants from the repository. In the DOE 2008 SEIS, mean results for 300 TSPA realizations were used to construct a combined scenario case that included the nominal, early failure, igneous intrusion, and seismic ground motion-fault displacement scenario classes. (Draft Supplement, Page A-3)

The TSPA provides probability-weighted dose results that do not represent the dose consequences of events were they to actually occur, which are referred to as conditional doses. An analysis of impacts of releases of radionuclides to groundwater that travels and discharges beyond the point of compliance should include a realistic presentation of these potential doses in order to make informed decisions about the acceptability of impacts. In cases where the conditional doses would be high but are masked by the low probability of the causal event, it is important that both the consequence (dose) and probability of the event occurring be disclosed so reviewers can be aware of the dominating role of probability in the NRC 2015 Draft Supplement's determination of impacts.

The igneous intrusion scenario class included in the TSPA provides a striking example of the effect of presenting probability weighted (risk) conclusions rather than conditional (realistic) dose results. DOE's Yucca Mountain Repository Safety Analysis Report shows in Figure 2.4-29(b) (page 2.4-445) the distribution of expected annual doses for the igneous intrusion modeling case for 1 million years after repository closure. This mean annual expected probability-weighted dose is approximately 1 millirem (mrem). If the probability of an igneous intrusion (approximately 10^{-7} to 10^{-8} per year) occurring sometime in the million years after repository closure is removed from the expected radionuclide flux at the compliance point resulting from such an event, the actual dose consequence could be several orders of magnitude larger. This result is important to the informed decision-making process intended by NEPA because the EPA standard for Yucca Mountain (40 CFR Part 197) sets an upper limit for individual dose from repository releases between 10,000 and 1 million years after closure at 100 mrem per year, albeit the standard applies to a probability-weighted dose calculated by a TSPA. In this case, NRC's use of DOE's TSPA masks the large and significant impact that could result should there be an igneous intrusion event at a Yucca Mountain repository.

COMMENT 10.0

THE 2015 DRAFT SUPPLEMENT CANNOT RELY ON YUCCA MOUNTAIN TSPA RESULTS FOR ITS IMPACT ANALYSIS SOURCE TERM BECAUSE THE ASSUMED TAD-BASED WASTE PACKAGE WILL NOT EXIST

DOE's 2008 Final Supplemental EIS (DOE 2008) assumes that all commercial spent nuclear fuel would be disposed in the Yucca Mountain repository in waste packages that include a transportation, aging, and disposal canister (TAD). (DOE 2008, 2-3) It further states, "The TAD canister is a component of systems that the NRC would (1) certify for the transportation of spent nuclear fuel under 10 CFR Part 71 and would license for surface storage at the respective

commercial sites under 10 CFR Part 72; and (2) would license for repository site transfer, aging, and geologic disposal under 10 CFR Part 63.” (*Id.*, 2-9.)

DOE’s Yucca Mountain TSPA incorporates DOE’s design specifications for a TAD canister into its radionuclide release and transport calculations. The TAD specifications include its maximum fuel assembly capacity and set limits for the thermal outputs of individual waste packages in the disposal drifts. Both of these parameters are integral to the calculations that make up the repository TSPA and constrain its results. DOE awarded contracts to two vendors to design and license TADs in 2008, but this work was terminated in December 2009 without completion of the designs. The contracts were finally closed in 2011 with no TAD designs having been submitted for regulatory review or approval.

Because of changing circumstances since 2008 in at-reactor storage of commercial spent nuclear fuel, the TAD design anticipated in the TSPA and DOE’s 2008 FSEIS will not be completed and the specifications and performance of possible future waste packages are currently unknown. Therefore, the NRC 2015 Draft Supplement has no technical basis for its reliance on the contaminant concentrations calculated in the TSPA for initiating its impact assessment at the regulatory compliance location.

“The concept of a canister system capable of storage, transportation, and disposal without repackaging has been considered for many years. Past standardization efforts include the transportation, aging, and disposal (TAD) canister system (DOE 2008) and the multipurpose canister (MPC).” (ORNL [Oak Ridge National Laboratory], 2015, page 1). DOE is now considering the generic bases for new performance specifications for what it refers to as a Standardized Transportation, Aging, and Disposal (STAD), but no decisions have been made to go forward with any STAD design. Based on studies of generic repository settings and rock types, DOE recognizes multiple options for STAD designs.

With the TAD canister no longer available as part of the repository system, and no known proposed replacement, the concept of operation of the repository and performance assessment in the 2008 Yucca Mountain Final Supplemental EIS is both incomplete and inaccurate and cannot be used as a basis for NRC’s 2015 Draft Supplement on groundwater impacts and impacts of groundwater discharges associated with a Yucca Mountain repository.

COMMENT 11.0

THE 2015 DRAFT SUPPLEMENT FAILS TO EVALUATE THE IMPACT OF THE PRESIDENT’S JULY 10, 2015 DESIGNATION OF THE BASIN AND RANGE NATIONAL MONUMENT ON THE PROJECT

The 2015 Draft Supplement does not acknowledge the July 10, 2015 Presidential designation of the Basin and Range National Monument in Nevada. The new national monument designation would affect between 25 and 30 miles of the proposed Caliente rail alignment identified in the DOE license application and associated EISs. The Draft Supplement does not recognize that, as a consequence of the Presidential Designation, the preferred rail access option for Yucca Mountain identified by DOE in the 2008 LA, 2008 FSEIS, and 2008 Rail Alignment FSEIS, is unlikely to

go forward. The new national monument designation will make it very difficult, if not impossible, for DOE to obtain the Certificate of Public Convenience and Necessity from the U.S. Surface Transportation Board, restore the land withdrawal from the U.S. Bureau of Land Management, and reapply to the State of Nevada for the water well permits required for construction and operation of the proposed Caliente alignment. This added uncertainty about the feasibility of constructing rail access to Yucca Mountain further undermines DOE's assumptions about the proposed use of TAD canisters as the central component of the waste disposal package for commercial spent nuclear fuel. This requires a revision of the license application and all NEPA-related documentation to accommodate uncertainty about the waste package and the TSPA calculations.

COMMENT 12.0

THE 2015 NRC DRAFT SUPPLEMENT FAILS TO PROVIDE A COMPLETE AND ACCURATE DESCRIPTION OF THE AFFECTED ENVIRONMENT

NEPA compliance requires a complete and accurate description of the environment to be affected or created by the proposed action, providing data and analyses that are "commensurate with the importance" of the impact. (40 C.F.R. § 1502.15.) Chapter 2 of the 2015 Draft Supplement purports to describe the affected environment of the proposed action, but contains major deficiencies that also undermine the resulting analysis of Yucca Mountain's environmental impacts.

The 2015 Draft Supplement's text and figures fail to indicate that the listed regulatory compliance location and the Amargosa Farms pumping location are within the Town of Amargosa Valley, an administrative subdivision of Nye County, Nevada. Moreover, the Draft Supplement figures fail to indicate that Yucca Mountain's groundwater impacts in Nevada would have a heavy concentration within the Town of Amargosa Valley. The Town of Amargosa Valley is not shown on any of the five figures that purport to illustrate the geographic region of influence for groundwater impacts and groundwater discharges to surface waters. An Amargosa resident who attended the September 17, 2015 NRC hearing pointed out that omission. (Comment of Brenda Diamond, Transcript at 28, 29.) One of the maps in the 2015 Draft Supplement, Figure 2-1, shows nearby populated areas, including Indian Springs, Pahrump, Beatty, and Death Valley Junction, but not Amargosa Valley. According to the 2010 US Census, Amargosa Valley has a population of 1,456. While not an official Census Bureau designated place, Amargosa Valley has a larger 2010 population than Beatty or Indian Springs.

The 2015 Draft Supplement also fails to acknowledge the locally significant presence of privately owned lands in the vicinity of the Amargosa Farms pumping location used for analyzing groundwater impacts. The Draft Supplement fails to identify the potentially affected privately owned properties, and the associated water wells, by owner. Likewise, the Draft Supplement fails to evaluate the potential direct and indirect social and economic impacts of Yucca Mountain groundwater discharges on privately owned land and water resources in the Town of Amargosa Valley. Any final EIS Supplement must be revised to provide a sufficient description of privately owned lands that would be part of the affected environment.

Figures 12.1 and 12.2, prepared by the State of Nevada, show the location of privately-owned lands and privately owned water wells relative to the regulatory compliance location and the Amargosa Farms pumping location. The final EIS Supplement must be revised to provide a sufficient description of the co-location of privately owned water wells and privately owned lands that would be part of the affected environment.

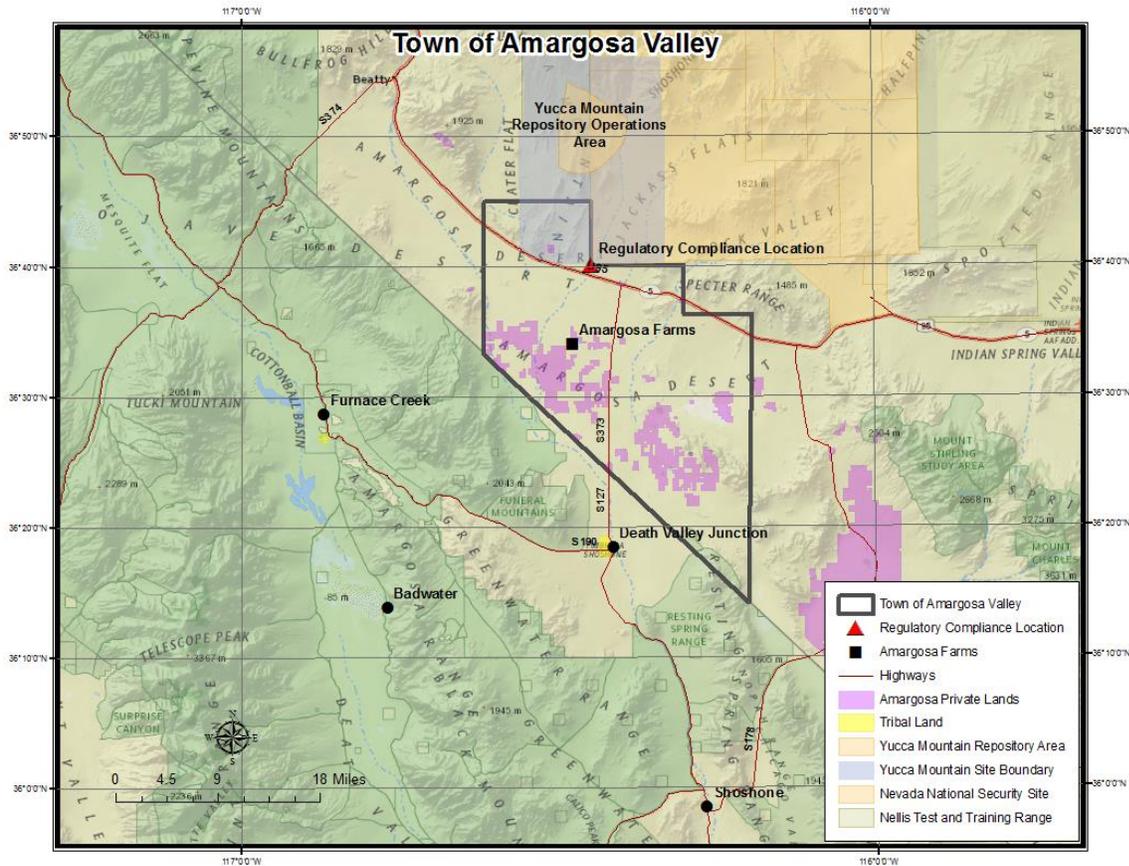


Figure 12.1

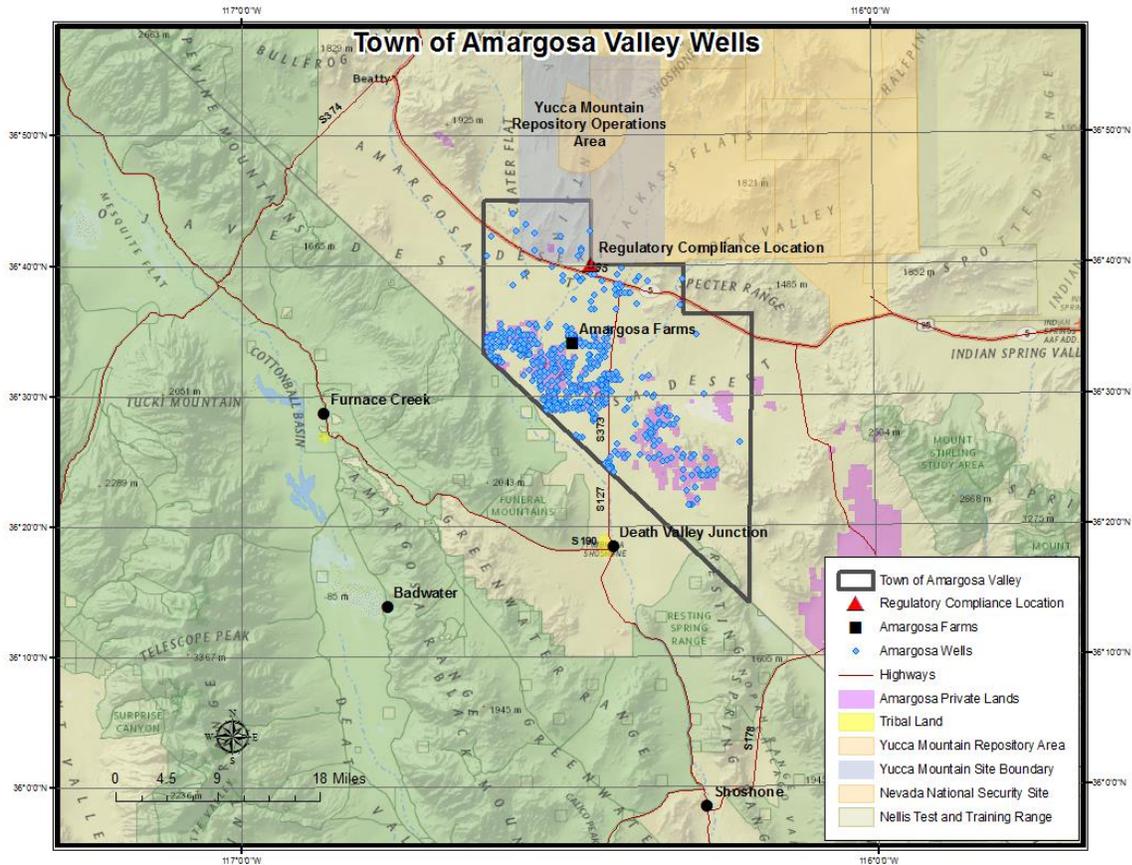


Figure 12.2

The 2015 Draft Supplement recognizes that DOE’s 2002 EIS and 2008 SEIS failed to adequately identify and describe affected environments beyond the regulatory compliance location. (2015 Draft Supplement, 2-1.) (Comment 18 below separately addresses impacts closer to the repository than this location.) However, the isolated analysis in the 2015 Draft Supplement creates the inaccurate impression that the proposed action, which includes the construction, operation, monitoring and closure of Yucca Mountain, would have benign consequences outside the limited area studied. As one illustration, despite years of extensive documentation and analysis from Nevada and other commenters on Yucca Mountain transportation issues, the 2015 Draft Supplement does not acknowledge or analyze the water quality and other environmental impacts associated with shipping nuclear waste through 43 states and numerous heavily populated areas throughout the United States, or in Nevada. “For the radiological impacts of transportation accidents or sabotage events,” DOE’s 2008 FSEIS and Rail Alignment FSEIS acknowledged that “the region of influence was 80 kilometers (50 mile[s]) from the railroad or highway.” (FSEIS, Vol. III, p. CR-413) The entire area impacted by repository groundwater releases in Amargosa Valley and much of northern Death Valley is located within the 50-mile region of influence for rail shipments along the Caliente and Mina rail alignments, and within the 50-mile region of influence for truck shipments along US Highway 95.

In the immediate vicinity of the repository, the 50-mile region of influence includes major surface water resources, including Fortymile Wash, Beatty Wash, and the Amargosa River. In Clark, Esmeralda, Lincoln, and Nye Counties, the 50-mile region of influence includes Lake Meade, Meadow Valley Wash, the White River, Coal Valley Reservoir, Cherry Creek, Echo Canyon Reservoir, Stone Cabin Creek, and numerous other important surface water resources.

The NRC 2015 Draft Supplement's evaluation of cumulative impacts is deficient in failing to consider the potential impacts on these surface and groundwater resources of radiological releases from rail and truck transportation accidents and sabotage events.

COMMENT 13.0

THE 2015 DRAFT SUPPLEMENT FAILS TO ANALYZE RADIOACTIVE RELEASES INTO THE GROUNDWATER, WHICH WILL CAUSE SERIOUS AND LONG-TERM IMPACTS IN VIOLATION OF NEVADA WATER QUALITY AND WATER USAGE LAWS

Contrary to NRC Staff's unsupported conclusion that the proposed Yucca Mountain repository would minimally affect the aquifer environment, the State of Nevada finds that the release of radionuclides and other hazardous substances from the repository into the groundwater is actually probable and would cause serious and long-lived damage to groundwater resources and to public health and the environment. Such discharges would, over time, accumulate and contaminate the larger aquifer and interfere with current and future beneficial uses of water. NRC Staff's cursory analysis in the Draft Supplement fails to identify, much less address, the environmental and economic impacts such contamination will have on the groundwater and on current and future users of water.

The impacts the repository poses to the groundwater would limit current and future beneficial uses and raise concerns for the State of Nevada's administration of its water law (contained in Nevada Revised Statutes (NRS) Chapters 532 through 534) and its administration of the Nevada Water Pollution Control Law (NWPCL), NRS 445A.300 to 445A.730. Since Nevada is the driest state in the country, the effects on Nevada of such water contamination are exacerbated and there are frequently no alternative sources of water to mitigate harm. Contamination of the aquifer diminishes water supplies for current and future beneficial uses and the diminution of water quality affects the kinds of beneficial uses available to such users. The NWPCL protects groundwater quality beyond protections afforded by the Clean Water Act and the Safe Drinking Water Act and application of its provisions, including Nevada's rigorous permitting program, should be addressed in the NRC Draft Supplement. Consistent with the NWPCL, the potential impacts to groundwater should involve an analysis of groundwater at the repository site rather than at a location eleven miles south of the repository. Similarly, Nevada water law is not preempted by federal law and should be specifically considered in the NRC Staff's 2015 Draft Supplement.

The Nevada Legislature has declared that pollution of water "adversely affects public health and welfare, [i]s harmful to wildlife, fish and other aquatic life, and [i]mpairs domestic, agricultural, industrial, recreational and other beneficial uses of water (NRS 445A.305)." NRC staff should

reconsider its findings and make appropriate adjustments and corrections to the final Supplemental Environmental Impact Statement on groundwater by including a more thorough analysis of the effects of significant groundwater contamination on water quality and the reduction of beneficial uses to which such water would be put. (See Attachment A, Letter from Leo Drozdoff, Nevada Department of Conservation and Natural Resources, to Cindy Bladey, NRC, November 4, 2015)

COMMENT 14.0

THE 2015 NRC DRAFT SUPPLEMENT MAKES ABSURD ASSUMPTIONS ABOUT FUTURE POPULATION IN ORDER TO MINIMIZE IMPACTS

NRC Staff assumes, as a basis for assessing impacts, that the current population in the area near Yucca Mountain will continue to be the same for the entire period analyzed and that the current range of human activities will also remain the same. (Draft Supplement, 1-3) Both assumptions seem implausible and likely to understate future harm. Las Vegas in 1950 had a population of 24,624, before its metropolitan area became the “fastest growing” population center in the country. (W. Acevedo, *Urban Land Use Change in the Las Vegas Valley* (USGS, 2013); article available at http://geochange.er.usgs.gov/sw/changes/anthropogenic/population/las_vegas/.)

The sole reference for the 2015 Draft Supplement’s static population assumption comes from the SER Volume 2, section 2.1.1.1.3.2 (“Regional Demography”), which fails to support using this assumption as an analytic constraint and contains more detailed population information excluded from the 2015 Draft Supplement. Although DOE provided population projections, it only covered the 50 year pre-closure period (SER 2, 1-7.) The population center currently nearest the proposed repository, Amargosa Valley, would likely not be far removed in size from the Las Vegas area when Nevada acceded to statehood. Indeed, Las Vegas looked a lot like Amargosa Valley less than one hundred and fifty years ago. Pahrump, located 35 miles southeast of the repository site, had a population of 24,631 in 2000. (SER 2, 1-8.)

COMMENT 15.0

THE 2015 DRAFT SUPPLEMENT ARBITRARILY ASSUMES A FUNDAMENTALLY FLAWED REGULATORY COMPLIANCE LOCATION, FAILING TO ANALYZE HARM WITHIN AN UNPRECEDENTED “SACRIFICE ZONE” OF GROUNDWATER CONTAMINATION.

The 2015 Draft Supplement’s insistence that the environmental effects of Yucca Mountain’s groundwater contamination and related surface discharges would be “SMALL” (5-1) has its starting point in the arbitrary selection of a regulatory compliance location that is around *11 miles* south of, and down the flow path of groundwater from, the Yucca Mountain repository location. (2015 Draft Supplement, 2-1; see also 10 C.F.R. §63.302 (describing the controlled area).) Nevada requests inclusion of the map posted at <https://www.nrdc.org/media/docs/020506b.pdf>, which visually represents DOE’s EIS description of the controlled area and depicts the direction of groundwater flow and the compliance boundary more clearly than any of the maps in the 2015 Draft Supplement. As discussed above,

the Draft Supplement fails to fully account for the potential spread of contamination beyond this location, toward areas such as Death Valley and Amargosa Farms. The Draft Supplement acknowledges that this location south of the repository—the closest location tested for environmental impacts—is “in the predominant direction of groundwater flow.” (2015 Draft Supplement, 2-1, n. 1)

This comment addresses a separate, major problem. The Draft Supplement concedes that the modeling and analysis did not even study contamination nearer to the repository than this 11-mile point.

The substantial public health problem posed by radionuclide contamination closer than the 11-mile point may well grow worse if the agencies’ optimistic speculation about future economic and physical conditions near the repository proves to be unfounded or short-lived, and other future communities locate closer to the site than the 11-mile point over the next million years. In effect, Yucca Mountain allows within the designated compliance boundary an unprecedented “sacrifice zone” encompassing the plume of radioactive leakage from the Yucca Mountain site to the point 11 miles away—a location far more distant than for any other compliance boundary for radiation standards known to Nevada. In previous usage, “controlled area” has referred to a far smaller area needed in a functioning geologic repository to isolate and contain the spread of waste. (See, e.g., *NRDC v. EPA*, 824 F.2d 1258 (1st Dist. 1987)) At Yucca Mountain, largely due to the ineffectiveness of its geologic isolation, the very real possibility emerges of major contamination dangers to future populations closer to the repository than the 11-mile point—dangers that have received no analysis or quantification in the Draft Supplement.

The 2015 Draft Supplement recognizes that to comply with NEPA guidelines and NRC procedures, the determination of environmental significance requires consideration of context (the “geographic, biophysical, and social setting in which effects are expected to occur”) and intensity (the “severity of the impact”). (2015 Draft Supplement, 1-4, 1-5; see also 40 C.F.R. § 1508.27.) For an EIS analyzing radioactive and non-radioactive contamination from Yucca Mountain over a million years, consideration of context will remain grossly incomplete unless the review provides full disclosure and analysis of environmental effects between the repository location and the 11-mile point. Underscoring the continuing need for that analysis, the 2015 Draft Supplement recognizes that the path was actually selected to allow for dilution of contaminants along the path of groundwater flow before reaching the compliance location. (2015 Draft Supplement, 2-1, n. 1.)

Moreover, considering intensity, the environmental review here must take account of the continuing reality that “[r]adioactive waste and its harmful consequences persist for time spans seemingly beyond human comprehension.” (*NEI v. EPA*, 373 F.3d at 1258.) “For example, iodine-129, one of the radionuclides expected to be buried at Yucca Mountain, has a half-life of seventeen million years. Neptunium-237, also expected to be deposited in Yucca Mountain, has a half-life of over two million years...” (*Id.* (quoting National Academy of Sciences report on Yucca Mountain).)

Regardless of how other issues are ultimately resolved, such as EPA's specific duties in setting public health and safety standards and DOE's in applying the TSPA to modeling runs, NEPA requires federal agencies to examine "to the fullest extent possible" proposed major federal actions that will "significantly affect the quality of the human environment." (42 U.S.C. § 4332.) To meet this requirement and honor NEPA's objective of informing decision-makers and the public, agencies conducting environmental review in compliance with NEPA must account for the full range of the proposed action's direct, indirect, and cumulative significant environmental effects. (See 40 C.F.R. 1508.8, 1508.27.)

The analysis of environmental impacts here will not fully account for Yucca Mountain's long-term effects without full disclosure and analysis of harm occurring in the area between the repository site and the point of compliance. Nothing suggests otherwise in the NWPA, which includes no such exemption and requires full NEPA analysis except for several enumerated exceptions. (See NWPA, § 114, 42 U.S.C. § 10134.) Under section 114(f) of the NWPA, 42 U.S.C. § 10134(f), it is neither "practicable" nor lawful to approve environmental analysis for an EIS that fails to fully account for Yucca Mountain's environmental consequences, and DOE's failure to conduct further analysis within 11 miles of the repository provides no excuse for keeping decision-makers and the public ignorant of these consequences, which could hardly be of greater importance for current and future generations. (See, e.g., K. Shrader-Frechette, *Mortgaging the Future: Dumping Ethics with Nuclear Waste*, 11 SCIENCE AND ENGINEERING ETHICS, Iss. 4 (2005).)

Likewise, nothing in *NEI v. EPA*, which invalidated EPA's previous Yucca Mountain rule and declined to reach the merits of numerous other subjects, removes the legal requirement and moral duty for environmental review of Yucca Mountain to fully analyze these impacts. The court, applying the record then available, invalidated the EPA's rule based upon the period rather than the point of compliance. However, the court did not reach the merits of DOE's environmental review and relied on NRC and DOE's recognition of the future opportunity to test its legal adequacy in connection with final decision-making. (373 F.3d at 1312-1314.) Moreover, the court opinion also emphasized Yucca Mountain's singular long-term dangers of radiation exposure, and invalidated the rule because it failed to heed the National Academy of Sciences recommendations to cover peak radiation exposure. (*Id.* at 1258, 1268-1273, 1314.) Accordingly, *NEI v. EPA* must not be taken out of context to excuse an environmental review deficiency that the 2015 Draft Supplement has failed to correct.

Lastly, the 2015 Draft Supplement is deficient in failing to analyze the factual basis for assumptions, apparently inherited from EPA rulemaking proceedings years ago, artificially limiting the expectation of drilling between the repository and the 11-mile point. These years-old assumptions cannot excuse a current failure to analyze potentially significant impacts. DOE has already drilled two deep water wells for human consumption in the ostensibly "controlled" area. The assumption that future generations will not drill in this area is not conservatively premised on the reality of scarce water resources in the arid West, and lacks credible factual support. It unwisely relies on the assumption that this substantial area, 90 miles from the one of the nation's fastest growing city, will remain undeveloped for many thousands or even a million years.

Moreover, the assumption that an RMEI location at the 11-mile point is more protective of public health than one closer to the repository is mistakenly premised upon dubious assumptions about well drilling and pumping costs that are likely to grow even weaker over time. Nevada, among others, extensively addressed and refuted these assumptions in rulemaking proceedings before the EPA on Yucca Mountain standards, and the 2015 Draft Supplement has thus far failed to reference or address that evidence, which undermines the notion that ignoring harm closer to the repository is any way health-protective. The 2015 Draft Supplement fails to document any evidence, much less compelling evidence, that drilling and pumping costs provide an effective long-term obstacle to further drilling and use of water for drinking and farming in areas closer than the 11-mile point. Notably, soils in the Lathrop wells area are similar to those of the farm area in the southwestern Amargosa Valley. It could therefore be possible for the RMEI to grow food using contaminated water. The same fine sandy loam soils extend some distance north, across the 11-mile compliance boundary, onto the Nevada Nuclear Security Site toward the repository location.

Ignoring harm within the compliance boundary also imprudently relies on passive institutional controls to continue long into the future, along with implausible limitations on future population growth in the area. According to the Yucca Mountain National Academy of Sciences (NAS) report, there is “no scientific basis for making projections over the long-term of either the social, institutional, or technological status of future societies” and “no scientific basis for assuming the long-term effectiveness of active institutional controls to protect against human intrusion.” (NAS Report, *supra*, pp. 106-107.) Even assuming future improvements in technology and communications, there is also “no technical basis for making forecasts about the reliability” of passive institutional controls. (*Id.* at 107.)

COMMENT 16.0

THE 2015 DRAFT SUPPLEMENT FAILS TO ACCOUNT FOR CUMULATIVE IMPACTS

The 2015 Draft Supplement’s cumulative impacts assessment is insufficient in several important aspects. NRC Staff correctly identifies mining as a potential contributor to cumulative impacts (Draft Supplement, p. 4-4.) Relying upon a 2014 Draft Resource Management Plan by the Bureau of Land Management (BLM), NRC Staff concludes that DOE’s omission of mining impacts “is not likely to have affected impact conclusions....” In making this finding, NRC Staff ignores the full potential impacts of future mining activities, described by BLM as potentially “negligible to moderate,” by asserting that impacts would be addressed “through best management practices and other mitigation.” (Draft Supplement, 4-8) The NRC Staff assertion of limited future mining potential and limited groundwater impacts is not supported by any meaningful analyses of future market conditions or industry practices.

The 2015 Draft Supplement assessment of cumulative impacts is also defective regarding the potential expansion of repository capacity. The Draft Supplement excludes consideration of emplacement of wastes beyond the 70,000 MTHM limit because the NWPA prohibits such emplacement until a second repository is in operation. NRC Staff currently regards such a

second repository as ‘not reasonably foreseeable.’ (Draft Supplement, 4-5) However, DOE included detailed plans for expansion of repository capacity and the resultant impacts in Chapter 8 of its 2008 Supplemental EIS, including detailed plans for expansion of underground facilities for additional waste emplacement. This contradicts NRC Staff’s assertion that the expansion of repository capacity is speculative and not reasonably foreseeable.

The Draft Supplement assessment of cumulative impacts must be revised to include recent developments regarding the Beatty low-level radioactive waste facility. NRC Staff finds that DOE “appropriately identified” the Beatty low-level radioactive waste (LLRW) site as a potential contributor to cumulative groundwater impacts after repository closure. (Draft Supplement, 4-5) NRC Staff finds DOE’s 2002 conclusion that the Beatty LLRW site would be “a small contributor to long-term cumulative impacts” to be reasonable and acceptable. (4-10) NRC Staff conclusions regarding DOE’s assessment of cumulative impacts goes on to state that “DOE adequately addressed possible contributions of radiological contaminants from the NNS and the Beatty LLRW site to cumulative groundwater quality impacts. The NRC concludes that the NNS and the Beatty LLRW and hazardous waste facilities are unlikely to contribute nonradiological contamination to groundwater. Further, NRC Staff concludes that while these sites could contribute to cumulative radiological impacts on groundwater along the flow path from the repository, the impacts would be reduced because of the attenuating effects of dispersion and radioactive decay as contaminants move through the groundwater flow path from the repository.” (Draft Supplement, 4-10.)

An unprecedented event that could potentially impact groundwater resources in Amargosa Valley occurred at the Beatty LLRW site on October 18, 2015. Over a period of about five hours, a series of explosions occurred, hurling 55-gallon drums as high as 60 feet in the air and producing an approximately 30-foot wide crater over one of the emplacement trenches. The event included a fire described as having orange flames five feet high. While there have been no indications to date of any release of radioactive materials off-site, full details of the causes and potential consequences of this event are not yet known. The State of Nevada is currently conducting a detailed investigation of these events. The investigation may not be completed for months, and remediation requirements are unknown at this time.

COMMENT 17.0

THE 2015 DRAFT SUPPLEMENT FAILS TO UPDATE DOE’S SPECIOUS AND OUTMODED ASSESSMENT OF THE NO-ACTION ALTERNATIVE

The 2002 FEIS and 2008 SEIS identify two No-Action alternative scenarios: scenario 1 is long-term storage of spent nuclear fuel and high-level radioactive waste at current sites with effective institutional control; scenario 2 is long-term storage of spent nuclear fuel and high-level radioactive waste at current sites with no effective institutional controls after 100 years. *See* FEIS at 7-1 and SEIS at 7-4. The environmental impacts of scenario 1, as assessed by DOE, are less than or comparable to the counterpart impacts arising from the proposed action (constructing and operating the proposed Yucca Mountain repository), with one possible limited exception. The exception relates to public and occupational health and safety impacts, but these impacts

may properly be regarded as comparable to or less than the radiological impacts from transportation of spent fuel and high-level radioactive waste to Yucca Mountain associated with the proposed action. *See* FEIS Readers Guide and Summary at Table S-1; SEIS Summary at Tables S-3 and S-4.

The environmental impacts of scenario 2, as assessed by DOE, are often very large. *See* FEIS Readers Guide and Summary at Table S-1 and SEIS Summary at Table S-3. Indeed, with one exception, all of the environmental impacts designated as “Large” are associated with No-Action Alternative scenario 2 (loss of effective institutional control after 100 years).

It is apparent that DOE recommended the proposed action under NEPA (construction and operation of a repository at Yucca Mountain) to avoid the “large public health and environmental consequences under the No-Action Alternative if there were no effective institutional control, causing storage facilities and containers to deteriorate and radioactive contaminants from the spent nuclear fuel and high-level radioactive waste to enter the environment.” *See* Readers Guide and Summary at pg. S-83. Indeed DOE even described the adverse radiological impacts arising from scenario 2 as “catastrophic.” *See* SEIS at 7-8.

However, if DOE’s No-Action Alternative scenario 2 is eliminated from NEPA consideration, as necessary to be consistent with the Generic Environmental Impact Statement for Continued Storage (GEIS) (NUREG 2157), the result is that the No-Action Alternative is the preferred alternative for the reasons given above. The 2002 FEIS cannot be adopted because it reaches the opposite conclusion. Moreover, the GEIS clearly constitutes a significant new piece of information or a significant new consideration that must now be taken into account in a Supplemental Environmental Impact Statement by DOE.

COMMENT 18.0

THE 2015 DRAFT SUPPLEMENT AVOIDS ASSESSMENT OF MAJOR RISKS TO ENDANGERED AND PROTECTED SPECIES

The potential for Yucca Mountain to facilitate the spread of radionuclide-contaminated groundwater into basins serving existing farming communities and desert ecosystems underscores the important need for an environmental review of the proposed Yucca Mountain repository to proceed in compliance with applicable laws providing species protection, and in recognition of the need to fully understand and address the repository’s effects on protected species and critical habitat. Section 4.2 of the 2008 ADR references the need for consultation for any Federal action that may affect endangered or threatened species, or critical habitat. (2008 ADR, 4-1.) The ADR also recognizes NRC’s obligation to comply with these requirements, including consultation required under section 7 of the Endangered Species Act (*Id.* (citing NUREG-1748)). However, the 2015 Draft Supplement fails to demonstrate with specificity that consultation and compliance with section 7 occurred as required. That important responsibility cannot be excused by the cryptic one-sentence reference in the 2008 ADR mentioning an NRC staff member’s conversation with a US Fish and Wildlife Service official without providing analysis. (4-2.) Rather, NRC Staff should have identified endangered or threatened species that might exist in the vicinity of discharge locations and undertaken an assessment of dose rates to

those species to determine if they might be affected at an individual, population or community level.

COMMENT 19.0

THE 2015 SUPPLEMENT EVADES RECOGNITION OF NATIVE AMERICAN CULTURAL HARM STEMMING FROM THE PROJECT'S GROUNDWATER CONSEQUENCES.

Section 3.2.1.4.3 of the 2008 ADR emphasizes the need to consider the “spiritual and philosophical aspects” of Native American cultural values and acknowledges DOE’s recognition that “Native American Tribes consider repository development to adversely affect elements of their cultural values and lifeways.” (2008 ADR, 3-12, 3014; see also 2002 EIS, § S.5.1.6.)

The 2015 Draft Supplement recognizes the cultural sensitivities and practices of several Native American tribes affected by the flow of groundwater from Yucca Mountain, in the Amargosa Valley area and at Death Valley Census County Division. (Draft Supplement, 3-37, 3-39.) Despite that recognition, the Draft Supplement impact assessment abruptly dismisses these concerns simply through the vague denial of “disproportionately high and adverse human health or environmental effects” from Yucca Mountain. (3-49, S-21.) The denial related to health concerns depends entirely on the TSPA-based modeling and arbitrary exclusions from analyses detailed above. Beyond that, this general denial is unresponsive to the recognition of distinct harm to cultural and spiritual values associated with groundwater and springs in these locations.

The 2015 Draft Supplement’s vague and patronizing denial of these harms without further analysis also contradicts the recognition elsewhere in the draft that “even small amounts of contaminants would be disrespectful to the springs and to the earth.” (3-27.)

The Timbisha Shoshone Tribe is an affected Indian tribe under the provisions of the Nuclear Waste Policy Act of 1982 (PL-97-425). An affected Indian tribe is defined as:

The term “affected Indian tribe” means any Indian tribe— (A) within whose reservation boundaries a monitored retrievable storage facility, test and evaluation facility, or a repository for high-level radioactive waste or spent fuel is proposed to be located; and (B) whose federally defined possessory or usage rights to other lands outside of the reservation’s boundaries arising out of congressionally ratified treaties may be substantially and adversely affected by the locating of such a facility: Provided, that the Secretary of the Interior finds, upon the petition of the appropriate governmental officials of the tribe, that such effects are both substantial and adverse to the tribe.

The Timbisha Shoshone Tribe has commented extensively on the 2015 Draft Supplement evaluation of groundwater impacts, including the following statements:

“The Supplement admits that contaminated groundwater effluent from the repository will reach springs that the Timbisha Shoshone hold as sacred and require to be kept pure. SEIS, p. 3-38. Yet the Supplement contains no consideration or meaningful analysis of this injury to Timbisha Shoshone cultural interests or how these effects can be prevented. *Id.* (only public

health and physiological impacts considered). This failure to adequately examine cultural and historical resources is in direct violation of NEPA's mandates. 40 C.F.R. 1502.16(g); CEQ Guidance; *see also* 10 C.F.R. § 51.71(b)."

"The United States has a trust obligation to ensure that the Timbisha's Reservation remains livable and self-sustaining. *Winters v. United States*, 207 U.S. 564 (1908). This is the exact standard that is applied to the water supply available to reservations, and by its terms (livable and self-sustaining) it applies both to water quantity and to water quality. It is the responsibility of the United States to ensure that the Tribal springs and groundwater sources remain free of radioactive contamination in perpetuity." (See Attachment B)

In addition to the Timbisha Shoshone Tribe, individual members of the Native American community living in and around the affected area have specifically detailed major cultural, environmental and health harm from Yucca Mountain improperly marginalized in the 2015 Draft Supplement. Western Shoshone and Southern Paiute people interviewed about the potential groundwater impacts of a repository at Yucca Mountain on water resources in the affected area repeatedly stated that water was a crucial part of their individual and collective cultural and spiritual life ("Water is our everything"), that all of the springs in the affected area are directly connected to each other, and that Native American people are responsible for preventing contamination of the springs. (See Attachment C)

The 2015 Draft Supplement's failure to address these Native American concerns is further compounded by failure to include detailed maps showing the likely groundwater impacts of the no-pumping scenario, documented in a previous report by Sandia National Laboratories for DOE, on Native American cultural and spiritual resources in the affected area. The Draft Supplement should have specifically included a graphic depiction of potential impacts on the springs in the Furnace Creek area, as shown in Figure S-4, Groundwater Flow Paths for the No-Pumping Scenario, found on page S-12, U.S. DOE, Analysis of Postclosure Groundwater Impacts for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada: Summary, RWEV-REP-0001-Update, October 2014.

The State of Nevada has prepared the following map (Figure 19.1) based on the information provided to NRC by DOE in the above referenced document. Nevada's map shows that groundwater discharges under the no-pumping scenario would be expected to impact both tribal lands and springs located on non-tribal lands in the Furnace Creek area.

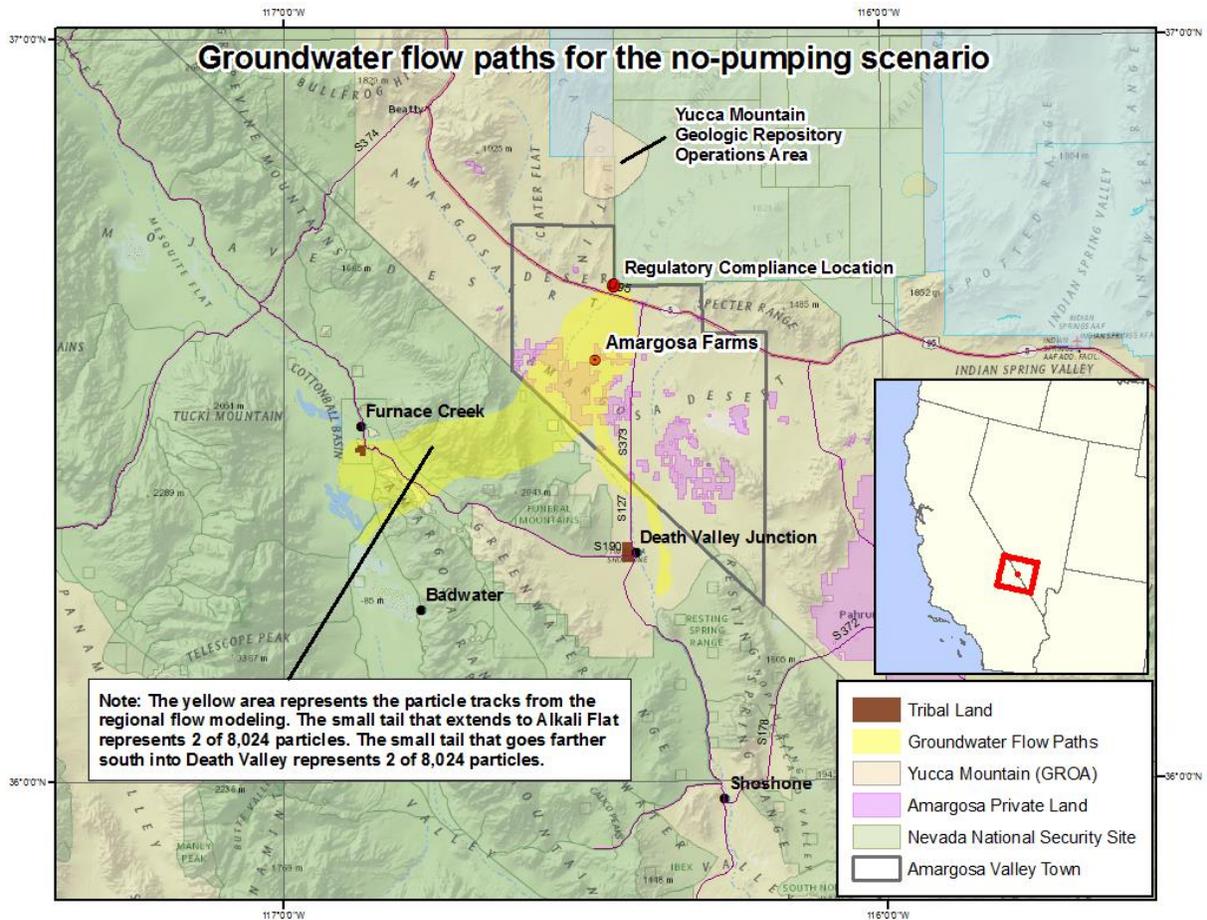


Figure 19.1

Additionally, the 2015 Draft Supplement fails to recognize potential cumulative impacts on groundwater resources of special concern to Native Americans. “For the radiological impacts of transportation accidents or sabotage events,” DOE’s 2008 FSEIS and Rail Alignment FSEIS acknowledged that “the region of influence was 80 kilometers (50 mile[s]) from the railroad or highway.” (FSEIS, Vol. III, p. CR-413) Virtually the entire groundwater resource area of concern to Native Americans in Amargosa Valley and much of northern Death Valley is located within the 50-mile region of influence for rail shipments along the Caliente and Mina rail alignments, and within the 50-mile region of influence for truck shipments along US Highway 95. Along the common segment of the Caliente and Mina rail alignments, the 50-mile region of influence includes major surface water resources of special concern to the Western Shoshone and Southern Paiute people: the Amargosa River, Lida Wash, Jackson Wash, Beatty Wash, and Fortymile Wash. DOE, in the Rail Alignment Final Supplemental Environmental Impact Statement (FSEIS), acknowledged that “[i]f an accident resulted in the release of radioactive materials, [Native American] food sources, both agricultural and subsistence, could be affected and mitigative actions would have to be taken to prevent contamination or consumption of

contaminated food...” [RA FSEIS, DOE/EIS-0369, CRD3-236] Water resources should be given the same consideration as food sources. The 2015 Draft Supplement evaluation of cumulative impacts should have considered the potential impacts on groundwater resources of radiological releases from rail and truck transportation accidents and sabotage events on these surface and groundwater resources that are of special concern to Western Shoshone and Southern Paiute people.

ATTACHMENT A

**NEVADA DEPARTMENT OF CONSERVATION AND
NATURAL RESOURCES COMMENTS ON THE
2015 NRC DRAFT SUPPLEMENT**

LEO M. DROZDOFF, P.E.
Director

BRIAN SANDOVAL
Governor

KAY SCHERER
Deputy Director

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Division of Water Resources
Division of Forestry
Division of State Parks
Division of State Lands
State Historic Preservation Office
Nevada Natural Heritage
Conservation Districts Program
Sagebrush Ecosystem Program

STATE OF NEVADA
Department of Conservation and Natural Resources

November 4, 2015

Cindy Bladey
Office of Administration
OWFN-12-H08
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

RE: Nevada Department of Conservation and Natural Resources Comments on the Draft Yucca Mountain Supplemental Environmental Impact Statement – Docket ID NRC-2015-0051

Dear Ms. Bladey:

The Nevada Department of Conservation and Natural Resources (DCNR) submits the following comments on the draft Supplement to the U.S. Department of Energy's Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada (NUREG-2184) prepared by U.S. Nuclear Regulatory Commission (NRC) staff to evaluate potential groundwater impacts associated with operation of the proposed high-level nuclear waste repository at Yucca Mountain.

DCNR is responsible for conserving, protecting, managing, and enhancing Nevada's natural resources. Through its Divisions of Environmental Protection (NDEP) and Water Resources (DWR), DCNR is required to protect and regulate Nevada's valuable and increasingly scarce water resources. Although NRC staff tentatively concludes that discharges of radioactive contaminants from the proposed repository would cause "small," environmentally acceptable impacts to groundwater, other credible scientific investigators reach a far different conclusion. DCNR has a duty to raise questions concerning the quality and scope of NRC staff's draft analysis and the realistic threats operation of the proposed Yucca Mountain repository present.

As demonstrated in the comprehensive State of Nevada comments on the draft EIS, Nevada's experts believe that the likelihood of discharges from the proposed repository is exponentially greater than NRC staff predicts and would create much more serious and long-term risks to the public and the groundwater resource itself. Indeed, these experts contend that the Yucca

Mountain repository would likely release radionuclides and other hazardous substances into the groundwater. Such discharges, even if individually small, would over time nevertheless accumulate and contaminate the larger aquifer and interfere with current and future beneficial uses of water. As a result of the unsupported and erroneous conclusion that any radionuclide releases would be “small” and insignificant, the NRC analysis fails to identify, much less address, the environmental and economic impacts such contamination will have on the groundwater resource and on current and future users of water.

The prospective impacts the repository presents to the groundwater itself as well as to beneficial uses of that water raises concerns for DWR’s implementation of the Nevada water code as set out in Nevada Revised Statutes (NRS), Chapters 532, 533 and 534. Nevada is the driest state in the nation; its water resources are minimal and finite; and any degradation to our precious resources is amplified. Contamination to the aquifer(s) not only reduces the amount of water of suitable quality for new appropriations, but has the potential to impact existing beneficial uses and water right holders. In addition, the probability of discharges of pollutants into the groundwater raises issues for NDEP’s administration of the Nevada Water Pollution Control Law, NRS 445A.300 to 445A.730, which applies to groundwater beyond the provisions of the federal Clean Water Act and Safe Drinking Water Act.

Therefore, the document should be revised to explicitly recognize and incorporate applicable Nevada water statutes into the analysis (NRS 532, 533, 534, and 445A). Further, pursuant to Nevada Water Pollution Control Law enacted at NRS 445A (see sections 445A.400, 445A.405, 445A.415 and 445A.465), except as authorized in a permit issued by the Nevada Department of Conservation and Natural Resources, these sections of the NRS collectively prohibit discharge of radioactive materials into groundwater or artificially induced alteration of the radiological integrity of groundwater. The analysis of the potential impact to groundwater must be expanded to include estimates of the overall impact to groundwater quality starting at groundwater directly beneath the potential repository location. The current analysis is focused on impacts to the alleged Reasonably Maximally Exposed Individual at a location 11 miles south of the repository, which is simply not reasonable or consistent with how Nevada implements its laws.

Consistent with the Nevada Legislature’s finding that pollution of water “adversely affects public health and welfare, [i]s harmful to wildlife, fish and other aquatic life, and [i]mpairs domestic, agricultural, industrial, recreational and other beneficial uses of water (NRS 445A.305),” DCNR respectfully asks NRC staff to consider the foregoing comments and make appropriate adjustments and corrections to the final EIS on groundwater by including a more thorough analysis of the effects of significant groundwater contamination on water quality and the beneficial uses to which such water would be put.

Sincerely,

Leo Drozdoff, P.E.
Director
Nevada Department of Conservation and Natural Resources

ATTACHMENT B
COMMENTS OF THE TIMBISHA SHOSHONE TRIBE
ON THE 2015 NRC DRAFT SUPPLEMENT



November 17, 2015

George Gholson,
Chairman

Earl Frank,
Vice Chairman

Eleanor Jackson,
Secretary/Treasurer

White Dove
Kennedy,
Council Member

Dora Jones,
Council Member

Cindy Bladey, Office of Administration
Mail Stop: OWFN-12-H08
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001.

Re: Comments on Supplement to Environmental Impact Statement for Nuclear Waste Repository at Yucca Mountain; Docket ID NRC-2015-0051.

To Whom It May Concern:

On behalf of Timbisha Shoshone Tribe (Timbisha), we submit these comments on the Nuclear Regulatory Commission's (NRC) "Supplement to the U.S. Department of Energy's Environmental Impact Statement for a Geologic Repository for the Disposal of Spent Nuclear Fuel and High-Level Radioactive Waste at Yucca Mountain, Nye County, Nevada" (Supplement or SEIS). For the reasons set forth below, the SEIS is wholly inadequate. The SEIS must be rewritten and re-issued pending additional consultation and feedback from Timbisha and with a more meaningful analysis of the environmental justice (EJ) concerns, groundwater contamination, and otherwise.

The Timbisha is a sovereign nation and its people are in closer proximity to the proposed Yucca Mountain Nuclear Waste Repository (Project) than any other Indian group. The Tribe has significant cultural, historic, religious and other stakes that are impacted by the Project. Ensuring full participation by the Tribe and fully analyzing impacts to the Timbisha Shoshone nation should be of paramount importance to NRC.

The Supplement ignores the devastating effect storing high-level radioactive waste at Yucca Mountain would impose on Timbisha's cultural and historic interests. NRC's conclusion that the Project's direct, indirect, and cumulative impacts would be "small" is uninformed and, from the Tribe's perspective, egregious. The Yucca Mountain repository would be highly destructive to the Timbisha Shoshone Indian community. The proposal is antithetical to the cultural and traditional values of the Tribe. Timbisha Shoshone are spiritual people. Radioactive contamination in groundwater and springs, for example, affronts the Timbisha's way of life, is disrespectful to cultural beliefs, and constitutes an environmental justice infringement on the rights of a sovereign nation. Yucca Mountain will have disproportionate impact on the Timbisha as a minority, and calling these impacts "small" is contrary to the law of the National Environmental Policy Act (NEPA), the Nuclear Waste Policy Act (NWPA), and NRC's own implementing regulations.

The SEIS is also an abbreviated effort to assess impacts without meaningful Tribal consultation. Rather than facilitate the Timbisha's participation, the Supplement was issued without *any* funding being provided to the Tribe to hire consultants and experts, which, by

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necessity, are required to provide analysis and feedback on the SEIS. Also, on a categorical level, the NRC staff impermissibly defers consideration of potential adverse impacts to Timbisha lands in California.

The nature and troubled history of the Project merit a careful examination of impacts in the Supplement, and the Timbisha has statutory rights to full consultation. The SEIS therefore should be rejected and shelved until funding and sufficient time is provided to allow for meaningful input by the Tribe.

I. STATUTORY BACKGROUND

The National Environmental Policy Act's implementing regulations spell out in detail what federal agencies, such as DOE and NRC, must do to comply with NEPA. 40 C.F.R. § 1500.1(a). Those regulations and the federal agencies' adherence to them are not mere technicalities that may be glossed over or treated lightly. Federal agencies shall to the fullest extent possible examine the impacts of a project under NEPA. As the Supreme Court explained:

NEPA's instruction that all federal agencies comply with the impact statement requirement – and with all the other requirements of § 102 – “to the fullest extent possible,” 42 U.S.C. § 4332, is neither accidental nor hyperbolic. Rather the phrase is a deliberate command that the duty. NEPA imposes upon the agencies to consider environmental factors not be shunted aside in the bureaucratic shuffle.

Flint Ridge Development Co. v. Scenic Rivers Ass'n, 426 U.S. 776, 787 (1976). In addition, federal agencies shall “[u]se all practicable means, consistent with the requirements of the Act and other essential considerations of national policy, to restore and enhance the quality of the human environment and avoid or minimize any possible adverse effects of their actions upon the quality of the human environment.” 40 C.F.R. §1500.2(f).

Environmental effects that must be analyzed under NEPA are interpreted broadly to include economic, social, and other environmental justice considerations. The “effects” to be analyzed include “ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, **historic, cultural**, economic, social, or health, **whether direct, indirect, or cumulative.**” *Id.* §1508.8 (emphasis added). The focus on historic and cultural effects or impacts is reiterated, in multiple locations, and a NEPA analysis “shall include discussions of... [u]rban quality, **historic and cultural resources**, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.” *Id.* § 1502.16(g) (emphasis added).

In addition, the Council on Environmental Quality (CEQ) created the following guiding principles for environmental justice analyses under NEPA:



- (i) consideration of the racial composition of the area affected by the proposed action, and whether there may be a disproportionate impact on minority populations;
- (ii) consideration of relevant public health and industry data and the potential for exposure to environmental hazards;
- (iii) consideration of “the interrelated cultural, social, occupational, historical, or economic factors that may amplify the natural and physical environmental effects of the proposed agency action”;
- (iv) development of “effective public participation strategies”;
- (v) assurance of “meaningful community representation in the process”; and
- (vi) assurance of “tribal representation in the process in a manner that is consistent with the government-to-government relationship between the United States and tribal governments, the federal government’s trust responsibility to federally-recognized tribes, and any treaty rights.”¹

Special emphasis therefore is placed on the importance of a NEPA analysis considering impacts to and consulting with Indian tribes. *See also* Executive Order 12898 (59 FR 7629) (Federal agencies responsible for identifying and analyzing impacts on minority and low-income populations).

Likewise, the Nuclear Waste Policy Act and NRC’s implementing regulations to promulgate NEPA policies specifically require that an SEIS consider and analyze the proposed repository’s potential historic and cultural impacts on Indian tribes. NRC’s regulations governing a NEPA analysis include:

Analysis of major points of view. To the extent sufficient information is available, the draft environmental impact statement will include consideration of major points of view concerning the environmental impacts of the proposed action and the alternatives, and contain an analysis of significant problems and objections raised by other Federal, State, and local agencies, by **any affected Indian tribes**, and by other interested persons.

10 C.F.R. § 51.71(b) (emphasis added).

As discussed below, the SEIS fails to adequately consider and analyze post-closure cultural impacts on the Timbisha Shoshone, as both NEPA and NRC regulations require.

¹ Council on Environmental Quality, *Environmental Justice: Guidance Under the National Environmental Policy Act 15-16* (1997), available at <http://energy.gov/nepa/downloads/environmental-justice-guidance-under-nepa> [hereinafter CEQ Guidance].



II. COMMENTS

A. THE SEIS FAILS TO ADEQUATELY IDENTIFY AND ANALYZE TRIBAL HISTORIC AND CULTURAL RESOURCES

Cultural impacts to the Timbisha from the Project are clear-cut, significant, and unmitigable. The SEIS's failure to meaningfully analyze and fully disclose these impacts is a glaringly deficiency under NEPA and NRC regulations.

Based on available data, the Timbisha has significant cultural, historic, religious, and other interests at stake that would be directly and severely impacted by the Yucca Mountain repository. The path of post-closure groundwater flow from Yucca Mountain runs to the Death Valley Regional Groundwater Flow System and Armagosa River watershed, which cover thousands of miles and include communities of Timbisha Shoshone Tribe. SEIS, pp. 2-1, 2-13, Figures 2-1, 2-3, 2-10. As the Supplement acknowledges, “[g]roundwater flow and potential releases traveling beyond the regulatory compliance location, if uninterrupted, would discharge in Death Valley” and “Death Valley is the ultimate discharge area for groundwater flow in the Death Valley Regional Groundwater Flow System.” *Id.* Death Valley is in the heart of Timbisha homelands.

The Timbisha have at least five distinct areas in harms way that would be impacted by the Project:

1. Timbisha Village and Surrounding Portions of Death Valley National Park. This area is particularly important to the Timbisha Shoshone people.² Along with a historic village, this area includes significant mesquite groves, Furnace Creek wash, as well as the Travertine Springs, Texas Springs, Navel Springs, and other springs.

This area is steeped in historical significance. More than 20 historic place names in the Shoshone language are recorded for this area, including: Tumpisakka (‘rock ochre’), from which the local area, and the larger Death Valley area takes its Shoshone name; Furnace Creek Wash (Padumpean Nunupi); Mesquite Canyon (Ohbitan Nabant); Mushroom Rock (Tugoboyoitsi, ‘the bird, desert flycatcher,’ important in the story of the theft of pine nuts, with which this site is associated), and others. For years immemorial, the Shoshone people have used, and continue to use, the important springs in the area: Travertine (Podoina, “bubbling up,”), which is important as a water source and also for its sacred medicinal properties; Nevares springs, which was also an important sacred area for curing and ceremony; Navel Springs, an important mountain sheep hunting ground (as was Nevares Peak and springs); and Texas Springs (Owiagonatsi), an important gardening site.

² Unless otherwise noted, the information provided has been gathered with assistance from Tribal members and a review of available but limited studies.



Present-day tribal members place great importance on the various locations within this area. The fact that the Timbisha Village has been somewhere within this tract for as long as people can remember is very important. In addition, there are other significant sites in the vicinity, including an important ceremonial mortar used at the time of mesquite harvesting that is now within the parking lot of the Furnace Creek Inn. There is also a historic and active cemetery immediately to the north and west of the Furnace Creek Inn. It is the site of graves of ancestors of most contemporary Timbisha Village residents, as well as other Tribal members. There is a ceremonial dance ground just below the Nevares Springs area, long used for medicinal purposes. The long history and continuity of this area makes it highly significant to present-day tribal members. Added significance is also attached to the mesquite groves within this district, not only a source of food but also of a representation of Tribal members' cultural and ethnic identity. These were the groves of their ancestors, the source of one of the two key summer and winter vegetable foods, the other being pine nuts. There are old camps in the grove, and in all likelihood, graves and other important properties.

2. Death Valley Junction and Surrounding Area. This area includes Greenwater Canyon, for example, which was an important place to hunt chuckwallas, a traditional food, and also an area with a large petroglyph panel. Greenwater Valley is known for doves and rabbits, and the high mountains had bighorn sheep. Timbisha tribal members recall hunts and there are important willow gathering areas within Greenwater Valley that are considered important for potential development to help revive the almost unsurpassed Death Valley and Panamint Shoshone basketry tradition. Other sites include Bennetts Well and Eagle Borax, which are well revered by Timbisha tribal members as is the large open pond at Eagle Borax that attracted water fowl and had duck hunting blinds.

3. The Ash Meadows and Vicinity. Ash Meadows was continuously occupied jointly by Timbisha Shoshone and by Southern Paiute people for at least 150 years. The large flowing springs and the mesquite groves attracted the people in the early years, and some set up homestead ranches in the early 1900s. Most of the Indian people in this area had gardens of corn, beans, squashes and various introduced plants, farming probably beginning in the early 1800s. These were irrigated with water from the springs. The area remains important to the Timbisha Shoshone. It contains several significant springs, including Fairbanks, Rogers, Longstreet, Point or Rocks, Devils Hole, Jack Rabbit Spring, Big Spring, Blue Spring and Last Chance Spring. Several large mesquite groves are also in the valley, and there are sites of ranches. Several of these springs are important areas for endangered pup fish and several plant species.

4. Death Valley Monument, Town of Beatty and Surrounding Area. This area was continuously used for seed and pine nut gathering, hunting and other purposes by members of the Timbisha Tribe. At various times, Tribal members also kept cattle and horses, for which they grew alfalfa, raised turkeys, collected large amounts of



pine nuts, both for their own use and for sale, and made wine from the wild grapes.

5. Stovepipe Wells and Surveyor's Well Areas. This area comprises of a number of locales associated with springs of importance to the Timbisha Shoshone people. In addition, this region has a number of historical camp areas. Traditional food plants, particularly greens are still collected by some Timbisha elders, who also appreciate the Chuckwallas population. Stovepipe Wells (Tugu'mu, Grosscup) is believed to have been an old camp with an area to the west on Mesquite Flats, where an intermittent stream from the Mesquite Springs waters a meadow that once wintered and grazed sheep and goats. Surveyor's Well (the Qhyy 'mesquite') is Located on the valley floor at approximately 60 feet below sea level and is also an area of great significance to the Timbisha.

The aforementioned discussion of cultural and historical resources are not comprehensive but limited due to resource and time constraints. Studies are needed to delineate the Timbisha's cultural and historic interests that are potentially impacted by the post-closure impacts from the Project. But even with this limited information, it's clear that storing high-level radioactive waste at Yucca Mountain would strip the Timbisha of its federally-conferred rights to continue traditional tribal religious and cultural activities associated with the springs and negatively impact other cultural and historic resources of the Timbisha.

The Supplement admits that contaminated groundwater effluent from the repository will reach springs that the Timbisha Shoshone hold as sacred and require to be kept pure. SEIS, p. 3-38. Yet the Supplement contains no consideration or meaningful analysis of this injury to Timbisha Shoshone cultural interests or how these effects can be prevented. *Id.* (only public health and physiological impacts considered). This failure to adequately examine cultural and historical resources is in direct violation of NEPA's mandates. 40 C.F.R. 1502.16(g); CEQ Guidance; *see also* 10 C.F.R. § 51.71(b).

There are numerous other deficiencies in the SEIS as well. For example:

The SEIS improperly and wholly excludes an analysis of the Timbisha's interests in California. The SEIS focuses on proposed activities within the State of Nevada but admits that some of the affected areas identified in the Supplement are in California. SEIS, pp. 3-34, 3-35. The NRC staff even "concludes that DOE would need to assess whether further consultation and investigation are necessary to account for potential impacts on cultural resources that may be located in [California] areas where groundwater discharges to the surface." *Id.* Likewise, NRC staff concludes "DOE would need to assess whether further consultation and investigation are necessary to account for potential impacts and potential cumulative impacts on historic and cultural resources that may be located in [California] surface discharge areas. SEIS, pp. 4-19, 4-20.

Deferring an analysis of the Project's impacts in California to an unknown future time prevents the Tribe from meaningfully evaluating the SEIS. There's also a risk that the



analysis will never be done at all. The whole point of NEPA is to study the impact of an action on the environment *before* the action is taken. See *Conner v. Burford*, 848 F.2d 1441, 1452 (9th Cir.1988) (NEPA requires that agencies prepare an EIS before there is “any irreversible and irretrievable commitment of resources”). Where “[i]nterim action prejudices the ultimate decision on the program,” NEPA forbids it. 40 C.F.R. §§ 1506.1(c)(1)-(3). Proceeding with the Project and approving the SEIS without an analysis of impacts to California Tribal interests is impermissible due to the inherent prejudice that this action threatens against the Timbisha Shoshone Tribe. The Timbisha’s statutory rights to be consulted on those impacts in California is eviscerated.

In addition, public health impacts also are not fully examined. The NRC staff, for example, did not evaluate the ingestion of crops, animal products, and fish as pathways for exposure in the Furnace Creek area. SEIS, p. 3-37. These impacts have the potential to impact the Timbisha people and must be delineated, as required for a full analysis under NEPA.

Finally, given that Tribal interests and lands exist along the Project’s proposed transportation routes for nuclear waste, any transportation accidents or other problems will also affect the Tribe and these impacts have not been fully analyzed.

B. NRC HAS FAILED TO SATISFY ITS STATUTORY OBLIGATIONS TO CONSULT WITH THE TIMBISHA SHOSHONE TRIBE REGARDING CONCERNS OVER THE YUCCA MOUNTAIN REPOSITORY

The United States Department of the Interior (“DOI”) formally determined on June 29, 2007 that the Timbisha Shoshone Tribe is an “affected Indian tribe” pursuant to the Nuclear Waste Policy Act, 42 U.S.C.A. § 10101(2). By virtue of having the affected Indian tribe status, the Tribe has been a party to all actions concerning the proposed Yucca Mountain site. The Timbisha received funding from the United States Department of Energy (“DOE”) in 2009 to assist the Timbisha with participating in the review and comment on the DOE’s Environmental Impact Statement for a Geologic Repository for Spent Nuclear Fuel and High Level Radioactive Waste at Yucca Mountain, Nye County, Nevada. The Timbisha fully expended all of the funds provided by the DOE during this lengthy process.

The Timbisha became aware that the United States Nuclear Regulatory Commission had issued a “Supplement to the U.S. Department of Energy’s Environmental Impact Statement for a Geologic Repository for Spent Nuclear Fuel and High Level Radioactive Waste at Yucca Mountain, Nye County, Nevada” when it received a copy of the NRC’s August 13, 2015 press release a few days after its release. The Office of Nuclear Material Safety and Safeguards only notified the Timbisha of the Supplement’s availability by letter dated August 21, 2015. The Timbisha was immediately concerned by the short time period for comment and the fact that the Timbisha had received no prior notice from the NRC that it was planning to issue the SEIS.



The Timbisha and its legal counsel did a cursory review of the SEIS and noted that groundwater studies and analysis were a prominent factor. As we have addressed elsewhere in this comment, the impact of potentially radioactive groundwater on Tribal lands and springs, both within and outside of our Reservation lands, is of tremendous concern to the Timbisha both because of public health concerns, as well as cultural and spiritual concerns regarding potential impacts to these sacred sites. The Timbisha realized that without in depth expert analysis of the SEIS concerning the potential impacts to groundwater, and perhaps other impacts that we have not been able to discern from our cursory and non-technical review, the Timbisha would be unable to fully and effectively participate in the SEIS comment process.

The Timbisha therefore determined that it must seek federal funding to be able to effectively participate in the SEIS process. The Timbisha has no funds of its own available for such purposes. The Tribe is located in a remote region of California and Nevada and to date has not been able to develop any economic ventures to supplement the grant funding it receives to operate its Tribal government.

The Timbisha made the following efforts to obtain federal funding to assist the Timbisha with preparing a comment on the SEIS:

- August 20, 2015 – Email to Deputy Assistant Secretary for Indian Affairs of the Department of the Interior Lawrence Roberts, received no response.
- August 21, 2015 - Telephone call with Jim Rubenstein of Nuclear Regulatory Commission. Mr. Rubenstein advised that NRC had no funding to assist the Timbisha with its review and comment on the SEIS, and referred the Timbisha to William Boyle of the DOE.
- August 24, 2015 – Email to William Boyle of the DOE.
- September 2, 2015 - Mr. Boyle emailed a response advising that the DOE also had no funding to assist the Timbisha with its review and comment on the SEIS.
- September 8, 2015 – Email to Superintendent Troy Burdick of the Central California Agency, Bureau of Indian Affairs, Department of the Interior, received no response.

The United States is obligated by its own law to provide additional funding to the Timbisha to comment on the SEIS. 42 U.S.C.A. § 10138(b) provides that the DOE shall give financial assistance to affected Indian tribes to study potential economic, social, public health and safety, and environmental impacts of the proposed repository. *See also* 42 U.S.C.A. § 10199. When the NRC issued the SEIS, new technical information was made available. The Timbisha must be given both the opportunity and the reasonable financial assistance necessary to effectively study the aforementioned impacts on the Timbisha, its



lands, and its members of the information set forth in the SEIS.

The NRC is duty-bound by the Nuclear Waste Policy Act to delay any consideration of the approval of the SEIS until the Timbisha has been given both the time and financial assistance necessary to effectively participate in the review and comment on the SEIS.

C. NRC HAS FAILED TO FULFILL ITS TRUSTEE OBLIGATIONS TO PROTECT TRIBAL LANDS AND INTERESTS

The NRC is obligated to delay any consideration any consideration of the approval of the SEIS until the Timbisha and the United States have fully analyzed the potential impacts on the lands held in trust for the benefit of the Timbisha.

The United States holds five parcels in trust for the benefit of the Timbisha (the “Reservation”). These five noncontiguous parcels were set aside for the Timbisha by the Timbisha Homeland Act, 16 U.S.C. § 104aa, Pub. L. 106-423, §§ 1-8, Nov. 1, 2000, 114 Stat. 1875. One of the central features of the status of lands held in trust for the benefit of a tribe is restraint against alienation. Only the federal government can extinguish this title once issued. *People of the Village of Gambell v. Hodel*, 869 F.2d 1273 (9th Cir. 1989). For purposes of consideration of this SEIS, this means that if the Tribal lands are impacted by this action of the federal government, only the federal government itself can approve any change to the land status of the Timbisha’s Reservation. This highlights the reality of the Timbisha: we have been here since time immemorial, and if something happens to our lands or groundwater which renders them uninhabitable, we can’t go anywhere.

The United States has a trust obligation to ensure that the Timbisha’s Reservation remains livable and self-sustaining. *Winters v. United States*, 207 U.S. 564 (1908). This is the exact standard that is applied to the water supply available to reservations, and by its terms (livable and self-sustaining) it applies both to water quantity and to water quality. It is the responsibility of the United States to ensure that the Tribal springs and groundwater sources remain free of radioactive contamination in perpetuity.

D. THE SEIS FAILS TO PROVIDE MEANINGFUL ANALYSIS OF ENVIRONMENTAL JUSTICE ISSUES IN EXECUTIVE ORDER 12898

Cultural and historical impacts to the Timbisha are summarily dismissed and are neither seriously considered nor discussed in the SEIS. NRC is shirking its responsibility, “to the greatest extent practicable and permitted by law,” to “make achieving environmental justice part of its mission by identifying and addressing... disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations.” Executive Order (EO) 12898, p. 1.

Among other things, EO 12898 established the creation of an Interagency Working Group on Environmental Justice (IWG) composed of representatives from 17 Federal



agencies and White House offices to accomplish its EJ objectives. The IWG was established to promote greater coordination and cooperation among Federal agencies, make government more accessible and responsive to communities, ensure integration of EJ policies, programs and activities of Federal agencies. The IWG Action Agenda notes the following goals:

- (i) Ensure that no segment of the population, regardless of race, color, national origin, or income, suffers disproportionate adverse human or environmental effects, and that all people live in clean, healthy and sustainable communities.
- (ii) Create opportunities for building partnerships between specific Federal agencies to promote comprehensive solutions to environmental justice issues.
- (iii) Promote models based in an integrated approach to addressing environmental, public health, economic and social concerns of distressed communities.
- (iv) Ensure that those who live with environmental decisions (community residents; state, tribal, and local governments; and the private sector) have meaningful opportunity for public participation in the decision-making process.
- (v) Provide a lasting framework for the integration of environmental justice into the missions of Federal Agencies.

Integrated Federal Interagency Environmental Justice Action Agenda, Environmental Protection Agency (EPA), p. 5. Within the context of the Action Agenda, “‘environment’ is defined pursuant to National Environmental Policy Act compliance and encompasses those elements that affects a community’s quality of life.” *Id.*, p 6. To the Timbisha people, cultural and historic resources are a large part of their quality of life.

After failing to fully consult with the Tribe, or perhaps because of this failure, NRC Staff falsely concludes that “no environmental pathway that would physiologically affect minority or low-income populations differently from other segments of the general population” and therefore there is no disproportionately adverse impact on the Timbisha in the Death Valley Area. SEIS, p. 3-38. No meaningful attempt is made in the SEIS to analyze and consider the Timbisha’s cultural and historic sensitivities. NRC staff even admits, for example, that “DOE would need to assess whether further consultation and investigation are necessary to account for potential impacts and potential cumulative impacts on historic and cultural resources that may be located in surface discharge areas.” SEIS, pp. 4-19, 4-20. As discussed above, the NEPA analysis and considerations of the Project’s impacts must occur now, before approval of the SEIS, not as a maybe afterthought for the future. The failure of NRC to meaningfully identify and consider the Timbisha’s



cultural and historic resources violates NEPA, EO 12898, and environmental justice principles.

III. CONCLUSION

Unless and until the Timbisha Shoshone Tribe is engaged and funded as an affected Indian tribe to participate in the SEIS process and the Tribe's cultural and historic concerns are fully addressed, the SEIS must not be approved. Full participation by the Timbisha is necessary to deliver on the promise of environmental justice.

Thank you for the opportunity to comment on these plans.

Respectfully submitted,

George Gholson
Chairman
Timbisha Shoshone Tribe

ATTACHMENT C

**NATIVE AMERICANS BELIEF IN WATER: AN
ENVIRONMENTAL JUSTICE CONTEXT**

Native American Belief in Water: An Environmental Justice Context

Ian Zabarte 2015

INTRODUCTION

Yucca Mountain, Nevada is undergoing licensing as a high level nuclear waste repository by the US Nuclear Regulatory Commission (NRC). Included in this study is the potential impact to Native Americans from the release of radiation into the groundwater from the proposed high level nuclear waste repository at Yucca Mountain, Nevada. Native American's tribal members have special expertise that result in a unique understanding of their environment through a shared sense of place along the Amargosa River. Their lifeways produce a perspective of risk that has not been understood despite past efforts by the Department of Energy's (DOE) Native American Interaction Program in place since the 1980's. For the purpose of Yucca Mountain site characterization, the DOE considers the whole of Native American society through a focus on cultural resources—in essence a social disconnect.

The general public including Native Americans rely on intuitive judgments called “*risk perceptions*.” Expert judgments and public intuition seem to suffer from the same biases: new evidence is consistent with one's initial belief; contrary evidence is dismissed as unreliable, erroneous and unrepresentative (Slovic 1987). According to Slovic's research the most important message is that the public conceptualization of risk is much richer than that of experts reflecting legitimate concerns that are omitted from expert risk assessment. The result of not considering public views including Native Americans is the failure of risk communication and risk management. Both the public perception and expert opinion must be respected.

The US NRC's supplement to the US DOE 2002 Environmental Impact Statement (EIS) and its 2008 Supplemental EIS is limited to the potential environmental impacts from the proposed repository on groundwater and from surface discharges of groundwater. The DOE conducted an analysis of environmental justice as required by Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations." This Executive Order directs agencies to identify and consider disproportionately high and adverse human health, social, economic, or environmental effects of their actions on minority and low-income communities.

The DOE environmental justice effort does not identify any high and/or adverse impacts to members of the general public. Further, DOE has not identified subsections of the population, including minority or low-income populations, who would receive disproportionate impacts. It has identified no unique exposure pathways, sensitivities, or cultural practices that would expose minority or low-income populations to disproportionately high and adverse impacts. This oversight has led the DOE Supplemental Environmental Impact Statement to conclude that no disproportionately high and adverse impacts would result from the Proposed Action of the DOE.

This study considers the Native American perspective that views the world as a seamless landscape with myriad connections to past, present and future use of land and water to protect and preserve the tribe.

APPROACH

There are many ways to conduct scientific research. One way is for researchers to go into a tribal community extract confidential information, construct scientifically meaningful databases or questions answerable with scientifically quantifiable methods, then interpret the results based on the external values and objectives of the researches conducting the study. This approach may work well for some research studies. In cases where the tribal community has already been adversely affected, however, this approach may have disastrous effect. It leaves tribal communities feeling used and victimized beyond the initial injury which prompted concerns for the need of research in the first place. A more logical approach for both the tribal community and scientists is to include the tribal community in collaboration with scientists to do the needed research.

This study uses an integrated approach using a Native American researcher to conduct interviews and interpret meaning from respondent's interviews. This approach allows the tribal community an opportunity to understand the needs of science as well as provide a level of openness in the communication of potential tribal impacts and concerns which would not otherwise be available to scientists. A tribal researcher can obtain a deeper understanding of the internal functioning of community, its practices and norms of behavior. This research could access the richness of tribal communities interpretation which they would not otherwise have access or opportunity to realize without the direct collaborative participation of community members in the research.

Our study takes place in October and November of 2015. A qualitative research approach is determined appropriate to obtain a broad range of meaning from respondents interviewed about

water contaminated with radiation discharged from the proposed Yucca Mountain site some time into the future. Participation by Native American respondents was voluntary and met fully with human subjects experimentation research protocol. Due to time and funding constraints, a Western Shoshone tribal member with expertise in conducting qualitative research and contacts with tribal community stakeholders conducted the study. Use of a tribal member aids in access to tribal communities, contact with tribal community stakeholders and facilitates the interpretation of context in interviews that are conducted.

Two tribes are identified with ties to the Yucca Mountain region for the study, the Western Shoshone tribe and Southern Paiute tribe. Of these two tribes, the Western Shoshone tribe has a treaty with the US that is, “in full force and effect” according to a 1990 opinion by the Federal District Court Judge Bruce Thompson. Application and effect of the Treaty of Ruby Valley (Map Attached) is politically contentious and not used by the DOE in scientific site characterization studies of Yucca Mountain. The interviewer is a Western Shoshone with strong political views critical of the US in general, and the DOE specifically, believing that exposure to radioactive fallout in atmospheric testing of weapons of mass destruction is responsible for the adverse health consequences known to be plausible from exposure to radiation that the Western Shoshone tribe experiences. Acknowledgment of the 1863 treaty by the DOE may have prevented the expenditure of time and over \$10 billion taxpayer dollars, but may have also acknowledged treaty obligations of the US. In 1998, one segment of the Western Shoshone tribe, the Timbisha Shoshone Tribe, sought involvement as an “affected Indian tribe” under the Nuclear Waste Policy Act of 1982 (PL-97-425). An affected Indian tribe is defined as:

The term “affected Indian tribe” means any Indian tribe— (A) within whose reservation boundaries a monitored retrievable storage facility, test and evaluation facility, or a repository for high-level radioactive waste or spent fuel is proposed to be located; and (B) whose federally defined possessory or usage rights to other lands outside of the reservation's boundaries arising out of congressionally ratified treaties may be substantially and adversely affected by the locating of such a facility: Provided, that the Secretary of the Interior finds, upon the petition of the appropriate governmental officials of the tribe, that such effects are both substantial and adverse to the tribe.

As an “affected Indian tribe” the Timbisha Shoshone Tribe is eligible for funding to conduct its own site characterization of the proposed Yucca Mountain site and participate as an admitted party to the NRC licensing proceedings. The Timbisha Shoshone Tribe was not formally contacted for this study and is anticipated to provide its own formal comments in the licensing proceedings. However, individual tribal members were contacted and did participate in this study.

The investigator contracted by the State of Nevada to conduct our study made initial contact to the Western Shoshone respondents was made by attending a cultural event at Poohabah, a traditional Native American healing center at Tecopa, California. Follow-up was made by telephone and site visits to each individual contacted. Southern Paiute people were contacted by telephone and then site visits made to each individual contacted on the Moapa River Indian Reservation at Moapa, Nevada. The study identified ten (10) individuals known to the interviewer to be knowledgeable of living tribal lifeways in the Yucca Mountain region. Six (6) individuals are Western Shoshone and four (4) are Southern Paiute. Seven (7) respondents are female and three (3) are male. Three

respondents are elders aged sixty (60) years and older, one is under thirty (30) years old. Six (6) respondents are in their fifties (50's). The interviewer made contact with additional tribal members from Western Shoshone, Southern Paiute and other regional tribes with interest and concern that are willing to participating but, could not be pursued because of time and funding restraints. No federally recognized tribes or tribes with affected tribe status were contacted, but should have been, if funding and time were available for a thorough study.

During each interview a map of the Death Valley regional groundwater flow system is provided to respondents to focus the interview. Transportation issues were briefly discussed. Each interview is taped and a copy of the interview accompanies this study. Major themes were identified before the interviews. Coding of interview responses was conducted after interviews were conducted. Respondents were interviewed individually or in groups of two. Respondent interviews were documented upon a rectangular matrix listing respondents and the common issues each reported when interviewed.

Theme/ Respondent/	Tribe	Home	Water is life	One water/ Connected	Medicine/ Plants/ minerals	Prevent Contami nation	Poison/ destroy tribe	Distrust Govern ment	Protective behavior/ Praying	Stigma	Enviro Justice
Darlene Graham	Western Shoshone	Poohabah/ Tecopa	X		X	X	X		X		
Barbara Durham	Western Shoshone	Timbisha/ Furnace Creek	X	X			X		X		
Mandy Campbell	Western Shoshone	Timbisha/ Furnace Creek	X		X		X		X	X	
Pauline Esteves	Western Shoshone	Timbisha/ Furnace Creek	X	X		X	X		X		
Vickie Simmons	Southern Paiute	Moapa	X			X			X	X	X
Deanna Domingo	Southern Paiute	Moapa/ Pahrump	X		X	X	X	X	X		
Unice Ohte	Southern Paiute	Moapa/ Logandale	X						X		
Vernon Lee	Southern Paiute	Moapa/ Tecopa	X	X	X				X	X	
Joe Kennedy	Western Shoshone	Timbisha/ Lida	X	X	X	X	X	X	X		
Patti Kennedy	Western Shoshone	Timbisha/ Lida	X	X					X		
Totals %			100%	50%	50%	50%	60%	20%	100%	30%	10%

DISCUSSION

Our study documents Native Americans beliefs about water, the use of water and the potential impact resulting from contamination to water used by tribal people. This is done within the context of environmental justice considering disproportionately high and adverse human health, social,

economic, or environmental effects of federal agency actions on minority and low-income communities. Nine (9) broad themes were considered for coding Native American responses.

Water is life, is a theme identified universally among respondents. This theme is viewed from the religious perspective of spiritual life; and from the perspective of physically life-giving nourishment that water provides.

A Southern Paiute respondent spoke of the Southern Paiute peoples sense of place as being where the water is, *“The people would all be where the water was. That’s path that everyone would take and how we would find all our stuff.”* Another respondent recalled a Southern Paiute elder, Clarabell Jim, now 100+ years old telling of the water flow from Forty Mile Wash when she was a little girl, *“There, that is where they got their salt. Then if the radiation gets in there, then the salts no good.”* The response demonstrates the Southern Paiute connection to the land and sense of place. Southern Paiute practice a ceremony called the Salt Song Trail that represent ancient villages, gathering sites for salts and medicinal herbs, trading routes, historic sites, sacred areas, ancestral lands and pilgrimages in the physical and spiritual landscape (Cultural Conservancy 2009). Another Southern Paiute respondent spoke of the water historically used by his family, *“Natives have a true connection to the land...being proper stewards of the land. Water is a sacred thing. It’s just life giving water...without water nothing happens.”*

Western Shoshone responses also shared the theme, water is life. *“Everything has a spirit. I believe in the water spirit.”* Speaking of how she knows, intuitively, *“I know water is life. Mineral water is good for your body. It is important to believe water will help them.”*

Another Western Shoshone respondent stated, *“Water is life, to animals and plants. It’s supposed to be pure...supposed to heal. It’s healing waters are known to be healing because of their warmth. They go there if they get sick...bathe and give prayers there. We have been here before written time. There have been a lot of people that tried to get rid of us. But, if it (radiation) is going to be detrimental to our health, then we have to take care of the people. If we got no water, then what? We supposed to survive on bottled water?”*

Another respondent spoke of Western Shoshone Spiritual Leader, Corbin Harney, recounting his story, *“He was supposed to go out and better the people and the environment through water. Then he figured it out. The spirit will come to him through water. Then he found healing water. Its very important.”* Corbin Harney spoke of the water talking to him, telling him to go to the healing water. Corbin Harney followed the message given to him by the “water spirit” for many years looking for the place told of, and in 1998 founded Poohabah at Tecopa, California. Poohabah means doctor water in the Shoshone language. Poohabah plays a role maintaining Western Shoshone traditional lifeways and sponsor Cultural Sharing Weekend(s) each year. Western Shoshone never know where or when the spirit of the land (or water) is going to come to them. Taking away or destroying these sacred landscapes may limit or destroy their connection to the “spirit” of the land, a living religious lifeway.

One water, is a theme that half of the respondents touched upon. This theme is viewed from two perspectives, that all water in its various forms are connected; and, all water in the Yucca Mountain

region and beyond in the Great Basin are physically connected. Additional time may have allowed this theme to be followed in each perspective and observed from all respondents.

Two (2) Western Shoshone respondents gave accounts of the physical connection of water. Speaking of radiation, *“It’s going to get there. My dad (Shoshone elder) tells a story of putting a vessel...didn’t know what it was made of, into Fish Lake and it popped out at Devils Hole. I wondered...it wouldn’t take a lifetime. How do we not know they are connected. There is also a story by my grandfather of a creature that goes back and forth between Walker Lake, Fish Lake and Deep Springs.”*

The second Western Shoshone respondent also mentioned two stories. *“A Paiute man spoke of his grandmother putting something into the water over here in Amargosa and it came up over here in Badwater. In Lone Pine...somebody put it in, a plant I think...put it in the aquifer, water running through Lone Pine there and it came up at here at Badwater. That’s two stories with the same outcome. Pahrump is separate. Devils Hole is on our side.”*

These two accounts demonstrate a prehistoric tribal knowledge and belief of the interconnected water flow system of the Yucca Mountain region. Western Shoshone *“know”* that radiation released from the proposed Yucca Mountain repository will reach the tribal community village at Furnace Creek in Death Valley, California.

A third account by a Western Shoshone elder also confirmed the physical water being connected. *“We are always involved in water at Amargosa cause of the flow. They’re all connected...Oasis*

Valley, Amargosa, Ash Meadows, Tecopa and Furnace Creek. It was a real river. That's the Indian name for Beatty, the "river."

The theme, medicine, plants, minerals is observed in half of the respondents. A Western Shoshone respondent spoke of water at Poohabah, Tecopa being, *"Mineral water...good for your body. At the pools I sing and give thanks for what our bodies need."* Water then, nourishes the physical body in health and in sickness. As aforementioned by the same respondent, *"Its important to believe water will help them."* This statement reflects the belief that any radioactive contamination is unacceptable and will do harm.

Another Western Shoshone respondent, the youngest of those contacted, spoke intimately of the water, *"Water is our everything. You have to have it for your food...crops, everything, our mesquite. Everything would die out here."* Mesquite is a food source, medicine and shelter that is in continuous use by the Timbisha Shoshone. Mesquite is important and is contemplated for future use by conservation planning today. (Attachment -Furnace Creek Land Uses)

The Western Shoshone elder stated that, *"We didn't want to be in one place and we make sure. That's why we have Scotty's Junction, Lida Ranch, all with water. Natives didn't live like that. Never over using it. We moved...then we would move on. They knew there was another generation of animals coming. They needed food for their young ones."* Water is viewed as essential to the land use and planning needs of the Timbisha Shoshone to nourish plants for consumption by indigenous animals and ultimately, conservatively, use and consumption of animals by the Western Shoshone people.

A Western Shoshone respondent speaking of radiation, *“Its not meant to be there...not supposed to be doing what they’re doing. When you take it away (water)...culture and religion when you should be able to use it. Once you take that water away from the people and they can’t use that water anymore that’s who they are being. That water give them these certain minerals...and that’s supposed to be there and makes them who they are. That’s they’re make-up is that water. If they don’t have it , that’s not who they are.”* The respondent identifies a sense of place and being of a Timbisha Shoshone. Their identity is connected to unique minerals in the water flows that are essential to the construction of tribal community identity. Radioactive contamination threatens the identity of the Timbisha Shoshone. *“Each spring has its own minerals and flavors. Certain muds are used to cleanse and suck out poison.”* Medicinal uses of water are clearly recounted by Western Shoshone respondents.

Protective behavior including praying was also universally addressed by all respondents. Praying is a living tribal lifeway that acknowledges the importance of life and the intent by tribal community to protect and conserve the land and water. A Southern Paiute respondent states, *“We have to save it because we might really need it, that water.”* Another Southern Paiute commented about water, *“Spiritual uses for it. You help the stuff grow. You don’t get the water to help like plants and stuff, you don’t get anything. You have to feed the earth...in order to help it grow. It was blessed. You blessed that water. You blessed that ground. You blessed those...”* Living tribal lifeways include praying as helping the land and plants, a conservation method.

Western Shoshone also use prayer as a protective behavior to protect and conserve the land and water in the Yucca Mountain region. A Western Shoshone respondent details traditional tribal religious practices, *“Always pray for the water here (Poohabah)...seeing things spiritually. At ceremony I offer water...to heal Mother Earth. Prayer pole, vision quests, morning circle and sweats at Yucca Mountain.”* Western Shoshone continue to practice traditional tribal ceremonies on their land at Yucca Mountain without DOE permission (Photo 1).

Another Western Shoshone respondent stated, *“You pray for everything, you pray for the sun to come up, water to flow and be pure and the human race to go on...everyone else too.”* You use it (water) to cleanse yourself, you use it to pray, make yourself good.”

Still another Western Shoshone respondent describes the water as sacred, *“When it comes from the sky and comes to earth...we have to take care of and respect it, use it in your prayers. The places where water is, are very important. Only spiritual people can go in there and use that water first. No one can go in there. The spiritual people go in there and talk to the water before anyone can go in there and use that water.”*

CONCLUSION

Western Shoshone and Southern Paiute people are spiritual people who continue to practice conservation and protective behavior through prayer which produces a shared sense of community—a living tribal lifeway. Each tribe depends on the purity of water for their continued existence as it flows from the land. Their tribal activity is based upon the use and conservation of water,

planning for future needs. Tribal community activities take place in the larger regional area and are not confined to reservation(s) boundaries. Tribal knowledge is drawn from a lifestyle of interdependence with the surrounding environment for food, water and the construction of tribal identity through conservation and prayer practiced in the tribal community. Prayer practiced in tribal communities is a method for bringing awareness to conservation of land and water, a living lifeway defining tribal identity and sense of place—passing down tribal knowledge to future generations. Native Americans need to have an ongoing connection to “place(s)” to maintain their identity as a distinct people. A failure of the environment can result in the ruin of tribal identity.

A different lifestyle, diet, shelter, mobility and prayer define Native American living lifeways. Prayer, conservation and protective measures are also used to pass on traditions and a sense of place. Based on lifestyle differences, exposure to Native American is likely to be higher than the non-Native American public. Increased exposure risk would be evidenced by difference in diet, what they eat and how they prepared their food; shelter, where they live and what their houses are made of; mobility, where they went, how long they spent there, and what they did there.

Lifestyle differences exist between the general public and Native American tribal communities. This idea has been reinforced over and over again by the US. Native American collaborative research has found significant increase in exposure to radiation based on lifestyle differences. The reasonably maximally exposed individual modeled for the Yucca Mountain project is not appropriate to use for Native Americans. The DOE has not considered alternative lifestyle more closely related to the Native American living lifeway found to exist in this study. Native American research has found that:

Because of differences in diet, activities, and housing, their radiation exposures are only very imperfectly represented in the Department of Energy dose reconstructions. There are important missing pathways, including exposures to radioactive iodine from eating small game. The dose reconstruction model assumptions about cattle feeding practices across a year are unlikely to apply to the native communities as are other model assumptions about diet. Thus exposures from drinking milk and eating vegetables have not yet been properly estimated for these communities. Through consultations with members of the affected communities, these deficiencies could be corrected and the dose reconstruction extended to Native Americans (Quigley and others 2000).

Participation by Native American respondents was voluntary and used methods that met fully with ethical standards of human subjects experimentation. Many respondents found during the interview process new insights and meaningful connections between past experiences and the present. These new insights suggest the possibility of deeper understanding and meaning not yet expressed. A follow-up study could unlock valuable knowledge about Native American experiences.

Use of a tribally affiliated researcher allows the tribal community the opportunity to understand the needs of science as well as provide a level of openness in the communication of impacts, concerns and derived meaning which would not otherwise be available to researchers. Additional positive benefits include a tribal community based understanding of nuclear issues. Also, researchers can obtain a deeper understanding and care of the internal functioning of tribal

community, its practices and norms of behavior, and gain an understanding of the richness of the tribal community which they would not otherwise have access or opportunity to realize without the direct participation of tribal member as the researcher.

Time was the most important resource lacking in this study leaving the researcher without sufficient time to conduct more extensive interviews and interpretation of more specific meaning. Failure to provide effective notice, funding and time to respond may be a cause of environmental justice for not providing Native Americans ample support and time for review.

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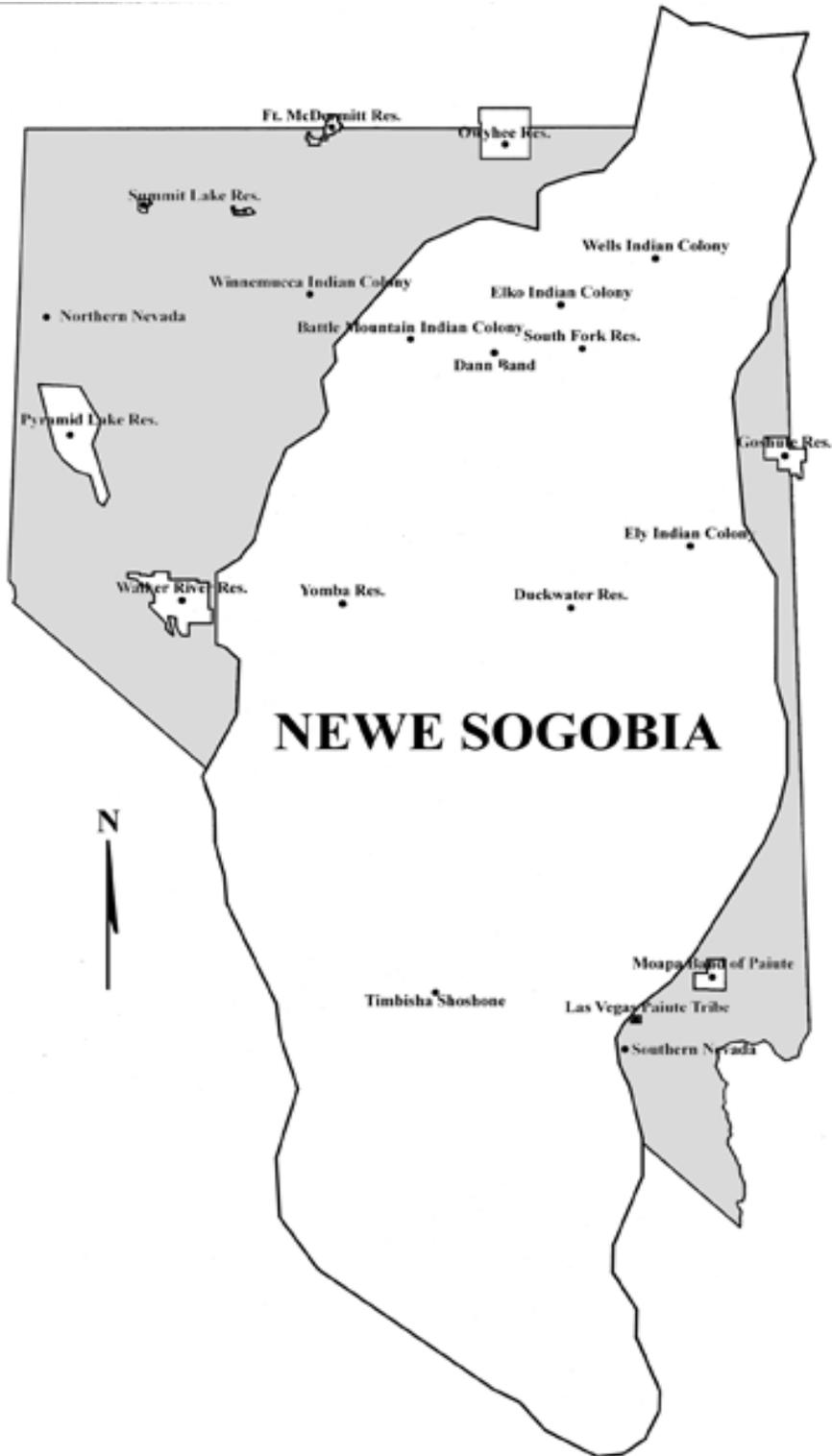
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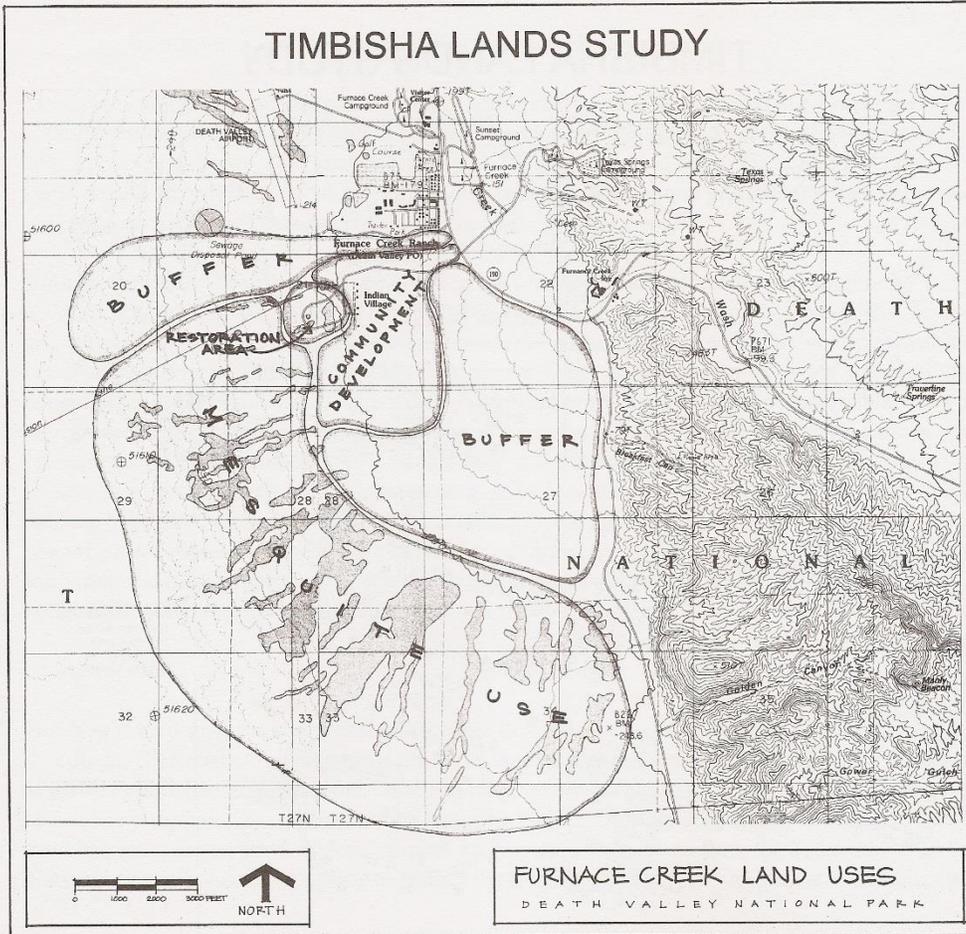
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Western Shoshone Treaty Land, Zabarte 2003

TIMBISHA LANDS STUDY



Map 4: Furnace Creek in Death Valley National Park showing proposed tribal use areas



Prayer pole/flag on Yucca Mountain, Zabarte Circa 2001.