December 19, 2008

United States Of America Nuclear Regulatory Commission
High Level Waste Application

In the Matter of	)	
	)	Docket No. 63-001
U.S. DEPARTMENT OF ENERGY	)	
	)	
(High-Level Waste Repository:	)	
High-Level Waste Application)	)	
	)	

NEVADA COUNTIES OF CHURCHILL, ESMERALDA, LANDER AND MINERAL

PETITON TO INTERVENE

I. Introduction to Petition

A. Introduction and Standing of Petitioner

Identification of Petitioner:

The Nevada Counties of Churchill, Esmeralda, Lander and Mineral

To the attention of:

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1. Basis for Standing:

The Nevada Counties of Churchill, Esmeralda, Lander and Mineral are Affected Units of Local Government (AULG) pursuant to the Nuclear Waste Policy Act, as amended. 42 U.S.C. §10247 et seq. Pursuant to Nuclear Regulatory Commission Federal Register Notice Vol. 73, No. 205, dated October 22, 2008, "any AULG seeking party status shall be considered a party to this proceeding, provided that it files at least one admissible contention in accordance with 10 CFR 2.309. An AULG need not address the standing requirements under that section."

II. Designation of Joint Contentions

1. Contentions designated below in the Table of Contents as Contentions A. and B. are submitted jointly on behalf of the Nevada Counties of Churchill, Esmeralda, Lander and Mineral Counties. The parties will act by unanimous concurrence through Armstrong Teasdale, LLP.

2. The Nevada Counties of Churchill, Esmeralda, Lander and Mineral Counties are joining in the following contentions to be submitted by Nye County, Nevada, copies of which are submitted herewith:

a) NYE-JOINT-SAFETY-5 (Failure to include the requirements of the National Incident Management System (NIMS), dated March 1, 2008, and related documentation in Section 5.7 Emergency Planning of the Yucca Mountain Repository Safety Analysis Report (SAR).

b) NYE-JOINT-SAFETY-6 (The LA lacks any justification or basis for excluding potential aircraft crashes as a category 2 event sequence).

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Attachment 2: Affidavit of Rex Massey.

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Attachment 4: DOE- Office of Civilian Radioactive Waste Management, Office of Logistics Managements Transportation Program Review, Presented to Nuclear Waste Technical Review Boards (NWTRB) Fall Meeting, September 24, 2008.

Attachment 5: Letter from Bradley W. Jones, Assistant General Counsel to Martin G. Malsch, March 20, 2008 (ADAMS ML080810175).

Attachment 6: Notice of Hearing and Opportunity to Petition for Leave to Intervene, 73 Fed. Reg. 63029 (Oct. 22, 2008).

Attachment 7: Affidavit of Mary F. Nugent.

Attachment 8: Affidavit of Alan Kalt.

Attachment 9: Affidavit of Ken Elgan.

Attachment 10: Affidavit of Gene P. Etcheverry.

Attachment 11: Affidavit of Edward Smith.

Attachment 12: Department of Energy Radiological Assistance Program Factsheet. http://www.nv.doe.gov/library/factsheets/RAP.pdf.

Attachment 13: Occupational Risk Consequences of Department of Energy's Approach to Repository Design, Performance Assessment and Operation In the Yucca Mountain License Application. EPRI, Palo Alto, CA: 2008. 1018058

Attachment 14: Western Interstate Energy Board, "Summary of the April 22-23, 2008 Meeting of the High-Level Radioactive Waste Committee, in Tempe Arizona."

Attachment 15: Rod McCullum, Nuclear Energy Institute Nuclear Waste Technical Review Board September 24, 2008 Presentation "Integrated System Operations Industry Perspectives."

Attachment 16: Affidavit of Engelbrecht von Tiesenhausen (Canisters)

I. Joint Contention – The Nevada Counties of Churchill, Esmeralda, Lander, and Mineral (4NC-NEPA-1)

II. Insufficient analysis in the Environmental Impact Statement of significant and substantial considerations of the environmental impacts of transportation by truck through the Four Nevada Counties.

III. Contention

1. Statement of issue of law or fact 2.309(f)(1)(i)

Applicant failed to effectively address key issues in the Final Supplemental Environmental Impact Statements regarding the transportation by truck of Spent Nuclear Fuel (SNF) and High Level Radioactive Waste (HLW), as required by the National Environmental Policy Act (NEPA), as applied in the Nuclear Waste Policy Act. 42 U.S.C. § 4321 et seq. (2006) (setting out the requirements of NEPA); 42 U.S.C. § 10247 (2006) (applying NEPA to the NRC process). Because transportation by truck has the potential for significant and substantial effects on the human environment, DOE must provide an analysis of the proposed action and means to mitigate harmful impacts in the EIS. *See* 40 C.F.R. § 1502.1 (2008). In addition, the Nuclear Regulatory Commission may adopt the EIS only if the document is complete, meaning significant and substantial new considerations do not render the EIS inadequate. 10 C.F.R. §51.109(c)(2) (2008). Because the Final SEIS, as submitted by DOE, is inadequate with respect to the transportation of SNF and HLW by truck, NRC erred in adopting the Final SEIS.

2. Explanation of basis 2.309(f)(1)(ii)

The document simply does not contain a sufficient, complete analysis of the number of trucks or the environmental impacts of transporting SNF/HLW by truck through Churchill, Esmeralda, Lander and Mineral Counties (the Four Counties). DOE has a burden, under NEPA and applicable regulations, to analyze the proposed action, its alternatives and mitigation. Section 114 (f) Nuclear Waste Policy Act (2006). The purpose of such analysis is to provide a "full and fair discussion of significant environmental impacts" in order to ensure NRC and DOE have analyzed all of the environmental impacts, with a mind towards NEPA's goals, of DOE's proposed action before NRC grants a license. 40 C.F.R. § 1502.1 (2008). DOE failed to meet its burden of analysis regarding the proposed action, the alternatives and mitigation measures. These analyses are critical to NRC's decision to grant a license, as NRC needs to determine, based on the content of the EIS, whether it is practicable to adopt the EIS. 10 C.F.R. § 51.109(c) (2008). The only way NRC can correctly make this determination is to either mandate that DOE further supplement the EIS or to condition the granting of a license on appropriate measures resolving these issues. 10 C.F.R. § 51.109(e)(1)-(3) (2008).

3. Issue is within scope of proceeding 2.309(f)(1)(iii)

The purpose of the EIS component of the application process is to provide clarity and guidance, as required by NEPA, on the environmental impacts in the Four Counties of constructing the repository, delivering, and storing SNF/HLW at Yucca Mountain. *See* 40 C.F.R. § 1502.1 (2008); 10 C.F.R. § 1021.103 (2008) (adopting CEQ NEPA regulations for DOE actions). "Implicit in NEPA's demand that an agency prepare a detailed statement on "any adverse environmental effects which cannot be avoided," is an understanding that the EIS will discuss the extent to which adverse effects can be avoided." Robertson v. Methow Valley Citizens Council, 109 S.Ct. 1835, 1847 (1989). Thus, NEPA requires DOE to consider the impacts of truck transportation and the mitigation of the "adverse effects" of transporting SNF/HLW by truck.

DOE itself demonstrated the issue is within the scope of the proceeding by including discussions of truck transport in the Final Environmental Impact Statement (FEIS). FEIS, Section S.13, Page S-90; Section 6.3, Page 6-54; Section 3.2, Page 3-118 et seq. This discussion goes so far as to select potential routes and specify upgrades to the roads that are necessary for safe transport (including widening of shoulders, upgrading pavement thickness, upgrading intersections and upgrading infrastructure). FEIS, Section 2.1.3.3.3.2, Page 2-57. Thus, DOE has acknowledged and opened the door for an analysis of the impacts & mitigation measures related to truck transportation. NRC should not allow DOE to subsequently deny the validity of this contention or ignore the environmental impacts which this contention addresses. Complete compliance with these statutory and regulatory mandates ensures that NRC will license the Repository only if DOE has comprehensive plans and procedures to transport SNF/HLW within the Four Counties in a manner that will not unduly harm the environment. *See* 40 C.F.R. § 1502.1 (2008) (stating that the primary purpose of the EIS is to serve as an action-forcing device to insure…policies and goals defined in the Act are infused into ongoing programs and actions of the Federal Government).

4. Issue is material to findings NRC must make 2.309(f)(1)(v)

Section 114 (f) of the Nuclear Waste Policy Act and 42 U.S.C. § 10247 (2006), applying the requirements of NEPA to the Yucca Mountain repository licensing process, require the Department of Energy to submit an Environmental Impact Statement, along with the License Application, to the Nuclear Regulatory Commission. NEPA and its implementing regulations require any agency proposing to undertake a "major federal action" to prepare an environmental impact statement considering both the impacts of the proposed action and the alternatives to the action. 42 U.S.C. § 4331 et seq. (2006). In addition, DOE is required by NEPA regulations to consider "means to mitigate adverse environmental impacts" in the EIS. 40 C.F.R. §1502.14 (2008).

Once DOE has prepared and submitted the EIS to the NRC, the NRC must determine whether to adopt the EIS or seek further supplementation of the EIS. 10 C.F.R. § 51.109(c)(1)-(2) (2008). Applicable regulations state that the NRC shall find it "practicable" to adopt any environmental impact statement unless significant and

substantial new information or new considerations render the environmental impact statement inadequate. Id.

a. *Department of Energy failed to provide a comprehensive analysis of the significant and substantial transportation impacts in the Final SEIS as required of the agency by NEPA and NWPA.*

The Final SEIS, submitted by the DOE, does not meet the Agency's regulatory burden of analysis for an EIS. NEPA regulations require DOE to consider the impact of its actions, alternatives which would "avoid or minimize adverse impacts or enhance the quality of the human environment" and mitigation measures. 40 C.F.R. § 1502.1 (2008); 40 C.F.R. § 1502.14(f) (2008) (requiring DOE to include mitigation measures not already included in the proposed action or alternatives). However, the EIS document herein only provides an in-depth analysis of the rail component of the mostly-rail transportation proposal; it does not fully address all components of the action, alternatives or mitigation. As stated in attached affidavits, the potential number of shipments is much higher than the 2700 estimated shipments in the EIS and previous agreements to avoid traveling through the Las Vegas Valley with any radioactive waste shipments could exacerbate transportation impacts in the Four Counties, as all of the SNF/HLW shipments will be routed from the North via Highway 95. Attachment One, Paragraph 7; Attachment Two, Paragraph 7 and 8. The result of a higher than estimated number of shipments and routing to avoid Las Vegas will be significant and substantial impacts on roads and the human environment. *See* Attachment One, Two and Three.

The Final SEIS fails to address or analyze one of the major components of the mostly-rail action, the purported 2700 overweight truck shipments, which will supplement rail transportation. Due to a number of factors, there is the potential for a significantly higher volume of truck transportation than the 2700 trucks the Final SEIS estimates. Attachment One, Paragraph 7. The document also fails to fully address alternatives or variables to the mostly rail scenario, such as a no or limited rail line scenario or a higher than predicted use of truck transportation if DOE is unable to complete the rail line as assumed. Multiple factors go into the timely construction of the rail line, including appropriation of funds by Congress and approval of the rail line EIS. Should funding be delayed or approval of the EIS be postponed by litigation, DOE would have to resort to shipping SNF/HLW solely by truck until the rail line could be completed. Despite these potential sources of delay, DOE simply assumes they will be able to complete all the necessary steps for the rail line in conjunction with the opening of the Repository. Attachment One, Paragraph 7. The Final SEIS also assumes generator sites throughout the country shipping SNF/HLW will have the ability to ship by rail, but does not discuss any basis for concluding this is a valid assumption. In addition, the Final SEIS does not address whether DOE will agree to avoid shipping any SNF/HLW through Las Vegas, which DOE has done in the past with respect to low level waste. Attachment Two, Paragraph 7 and 8. Avoiding Las Vegas will cause all of the trucks to more frequently utilize other routes from the North, through the Four Counties. Finally, the Final SEIS does not adequately address the environmental impacts of using overweight trucks to transport SNF/HLW through the Four Counties or mitigation

measures for this proposed action. The damage to roads will be significant and substantial, as will be the improvements necessary for environmentally safe transportation of overweight trucks on the non-interstate roads in Nevada. Attachment Three, Paragraph 13. While DOE is not required, by law, to formulate and adopt a complete mitigation plan, the US Supreme Court has stated that the "omission of a reasonably complete discussion of possible mitigation measures would undermine the...function of NEA." Robertson, 109 S.Ct. 1835, 1847 (1989). Regulations define "mitigation" as avoiding, minimizing, rectifying, reducing or compensating for impacts. 40 C.F.R. §1508.20(a)-(e) (2008).

In the Final SEIS, DOE discusses, analyzes and quantifies, in detail, the traffic adjacent to the Yucca Mountain site in Nye County, Nevada. Final SEIS, Section 3.2.3, Page 3-97. This discussion includes an analysis of the impacts on traffic congestion. In addition, the Final SEIS mentions a few major routes in Clark County, Nevada. Id. No explanation or discernable reason is present regarding why DOE would pick out these areas for analysis, but not any other Nevada counties. Focusing the transportation analysis on these select areas is especially illogical when one considers that the Four Counties will experience transportation impacts as great as or greater than the areas analyzed in the Final SEIS. *See* Attachment Three. The truck transportation plan will create a funneling effect, in which trucks arriving at Yucca Mountain from throughout the country will converge in Nevada. In the past, DOE has implemented a policy preventing DOE from transporting any Low Level Radioactive Waste through the Las Vegas Valley. Attachment Two, Paragraph 7 and 8. Because of this earlier DOE policy, it is predictable that DOE and implement the same policy with regard to SNF/HLW and, as a result, an even greater amount of SNF/HLW will be transported through the Four Counties from the North of the Repository (Highway 95 is the most likely route to be utilized in avoiding Las Vegas). *See* Attachment Two and Three, Paragraph 11 and 12. Due to these facts, the Four Counties will, collectively, see almost all of the trucks transporting SNF/HLW to Yucca Mountain travel through their counties.

DOE would not have included the analyses of traffic near the repository if they did not consider traffic impacts material to the EIS analysis. Given this, the Commission should not allow DOE to subsequently argue that transportation impacts in the Four Counties are not significant and substantial considerations. The EIS must address all of the aforementioned in a comprehensive manner in order to be a complete analysis of the impacts of the proposed actions, alternatives and mitigation. Thus far, DOE has not completed any analysis of transportation by overweight truck at the DOE predicted level of truck volume and DOE has not discussed alternatives to the predicted volume, such as a higher than estimated reliance on truck transport. DOE has not discussed the environmental impacts of overweight trucks or mitigation measures for protecting the human environment. In short, DOE has failed to meets its burden under NEPA of analyzing the significant and substantial environmental impacts, alternatives and mitigation measures to its proposed action of transporting a portion of the SNF and HLW by overweight truck to the Repository at Yucca Mountain.

b. The NRC erred in deciding to adopt the Final SEIS under applicable regulations for licensing the repository.

The Final SEIS, as submitted by DOE, does not meet the regulatory standards for adoption by the NRC. In a proceeding for the issuance of authorization to construct the Repository, the Commission is required to adopt the environmental impact statement prepared and submitted by the Secretary of Energy to the extent "practicable." 10 C.F.R. § 51.109 (a)(1) (2008). The regulations state NRC shall find it "practicable" to adopt an environmental impact statement unless "significant and substantial.... new considerations render such EIS inadequate." 10 C.F.R. § 51.109(c)(2) (2008). Per the March 20, 2008 letter to Mr. Martin Malsch and the October 22, 2008 Federal Register Notice, "substantive claims challenging the FEIS will be considered "new considerations" in the context of §51.109(c)." Attachment Five; Attachment Six. In short, the Commission my not accept the Final SEIS, as submitted, because it did not address "significant and substantial considerations" with respect to truck transportation, which renders the document inadequate. Contrary to this regulatory standard, NRC adopted the Final SEIS provisions dealing with environmental impacts resulting from the transportation of SNF/HLW.

The Final SEIS, submitted by the Secretary of Energy, is not complete enough to meet the burden of acceptance the Commissioner has under this regulatory section. The document does not adequately address many issues regarding transportation of SNF/ HLW by truck. In the Final SEIS, DOE suddenly announces there will be 2700 overweight truck shipments of SNF/HLW, without providing any explanation or analysis of this number. Final SEIS, Section S.4.3, Page S-47. But, despite this new, revised transportation plan, DOE did not analyze transportation impacts of overweight trucks in its Final SEIS. Granting a license by the NRC will result in a high number of overweight trucks transporting SNF/HLW through the Nevada Counties. As is clear from the attached affidavits, the Final SEIS does not consider or discuss fully a number of impacts on the environment, such as impacts on roads, impacts on communities, traffic impacts, and road infrastructure improvements necessary for safe transportation. *See* Attachment Three. Clearly, this is an instance of both impacts resulting from the grant of a license not addressed by the DOE's EIS and a significant and substantial new consideration in the licensing process requiring analysis.

In summary, the Final SEIS, submitted by the DOE, is inadequate and, thus, the Nuclear Regulatory Commission's determination to adopt the Environmental Impact Statement with respect to transportation issues is incorrect. In order to comply with statutory and regulatory burdens of adoption, DOE or NRC must analyze the complex issues presented by transporting SNF/HLW by overweight trucks.

5. Statement of alleged facts or opinions and references to be relied upon and references to specific portions of application petitioner disputes 2.309(f)(1)(v)- (vi)

DOE has not fulfilled its NEPA obligations because it has not completed an analysis of the overweight truck transportation action, yet the Final SEIS states that

overweight truck shipments will substitute for rail transport where commercial generating sites do not have the ability to load rail cars. Final SEIS, Section S.2.4, Page S-19. In order to comply with statutory and regulatory burdens of analysis, DOE must analyze the environmental impacts of shipping SNF/HLW by overweight truck and mitigation for shipping by overweight truck. Overweight truck shipments are a component of the "mostly rail" shipment plan and, as a component of a proposed action, need to be analyzed. In addition, due to various factors, there is the potential for a much higher volume of truck shipments than what DOE estimates in the Final SEIS and previous policy to route around Las Vegas are likely to be implemented again, resulting in an exacerbation of the impacts on the Four Counties. Attachment Two. As a result, there will be significant and substantial impacts on the environment, roads and human health. Due to the potentially enormous impacts on the environment when DOE transports SNF/HLW by overweight truck through the Nevada Counties, failing or shortchanging an analysis of transportation by truck is a gross oversight by both DOE and NRC.

a. DOE has failed to analyze a significant and substantial component of the "Mostly Rail" transportation plan.

In the Final SEIS Comment Response Document, DOE claims the mostly rail transportation mode is the preferred mode of transportation and, therefore, the DOE does not need to consider or analyze in any EIS documents an overweight truck scenario. Final SEIS Comment Response Document Vol. 3 Section 1.4.1, Page CR-217. However, the Final SEIS also states that the DOE "can not use rail shipping exclusively because some commercial nuclear generating sites do not have the ability to load large capacity rail shipping cars. Those sites that are incapable of rail shipments would use overweight trucks to ship materials to the repository." Final SEIS, Section S.2.4, Page S-19 and Section 6.1.6, Page 6-5. However, DOE has not analyzed the environmental impacts of shipping via overweight trucks and claims there is no need to because "mostly-rail" is the selected mode of transportation. Yet, DOE plans to rely fully on overweight trucks whenever rail transport is not available. Rail transport may be the primary mode of transportation, but overweight trucks are clearly a significant component of that transportation plan. Overweight truck transport must be evaluated as a part of the proposed action, just as DOE evaluated rail transport.

b. DOE has not justified why its arbitrary assumptions regarding the volume of truck shipments are valid.

DOE has not explained how it reached its estimates of 2700 truck shipments based on the actual capacity of sites sending the waste to the Repository or why its is appropriate to assume, without question, the railroad will be constructed before shipping of SNF/HLW commences. In actuality, the volume of trucks could be much higher than 2700 overweight trucks because DOE's entire analysis of truck transportation impacts rests on a few critical, arbitrary assumptions about shipping by rail. *See* Attachment One.

The Final SEIS states that there will be approximately 2700 shipments by truck. However, DOE has not adequately explained why only certain sites will be shipping by

truck or why it assumes all other sites will have the capacity to ship by rail. In fact, a National Academies study concluded that DOE based the transportation capability estimates in the EIS on a study published in 1992. National Academies, Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States 223 (National Academies Press 2006). Because DOE completed the study so long ago, it is quite likely that changes have occurred and "rail line abandonment was tending to curtail rail access to reactor sites." Id. In addition, DOE has absolutely no way of knowing or depending on the timely completion of a rail line. Attachment One, Paragraph 7(a)(i). To base the entire truck transportation impact analysis on the assumed construction of a rail line is arbitrary, capricious and indefensible. If the rail line was delayed or a generator shipped by truck rather than rail, the number of truck shipments could reach as high as 49,000 commercial SNF shipments, 8,315 HLW shipments and 3,470 DOE SNF shipments. Attachment One, Paragraph 7(a)(i). While this number is obviously a worst case scenario, given the aforementioned information, it is entirely possible that the number of overweight truck shipments will be much higher than the 2700 truck shipments estimated in the Final SEIS. DOE must provide more specificity and a wider range of analysis regarding the actual number of truck shipments so that the impacts of the proposed action, along with the necessary mitigation, can be clearly and accurately calculated.

c. DOE has not addressed the likelihood of an agreement between Clark County and DOE regarding transporting SNF/HLW through Las Vegas.

Historically, DOE has avoided any shipment of low level waste through any portion of Las Vegas. Attachment Two, Paragraph 7 and 8. It is very likely that DOE will follow a similar policy for SNF/HLW. Assuming this comes to pass, the exacerbation of transportation impacts on the Four Counties will be apparent. In order to avoid Las Vegas in traveling to Yucca Mountain, DOE will have no choice but to route all of the shipments from the North, through the Four Counties, and down Highway 95.

d. DOE's FEIS and Final SEIS are an insufficient analysis of the significant and substantial impacts resulting from overweight truck transportation.

DOE's assumption that a detailed analysis of overweight truck transport in the Final SEIS is not necessary is simply incorrect. First, the heavy haul analysis from 2002 does not address the issues presented by the updated, Final SEIS transportation plan relying on overweight trucks. Second, neither the initial 2002 analysis of truck transport, nor the Final SEIS addresses many of the issues related to environmental impacts and mitigation thereof. The 2002 and 2008 analyses, considered either in combination or separately, do not address the significant and substantial impacts on the human environment resulting from SNF/HLW truck transport, especially if one considers truck transportation within the context of the potential for higher than estimated number of trucks and the Las Vegas routing issues. *See* Attachment One through Three.

DOE analyzed a mostly legal-weight and mostly rail transportation scenario in the 2002 Yucca Mountain FEIS. FEIS Section, 2.1.3.3, Page 2-48. DOE also conducted an

analysis of a heavy-haul truck scenario, which included a limited analysis of routing, impacts and mitigation. FEIS Section, 2.1.3.3.3.2, Page 2-57. However, in the 2008 Final SEIS, DOE determined the trucks transporting SNF/HLW would be by overweight trucks. Final SEIS Section 6.1.6, Page 6-5. Heavy-haul versus overweight transportation scenarios involve a different set of regulatory and factual circumstances, which will cause different impacts. Despite DOE's admission in the Final SEIS that heavy-haul impacts "differ" from overweight impacts, DOE seems to assume that an analysis of heavy-haul or legal-weight trucks from 2002 can suffice as analysis of its decision to use overweight truck in 2008. Id. This, simply, is not an appropriate assumption and, more importantly, does not meet the NEPA burden of analysis. The two types of transportation involve different shipping containers, different rates of speed/travel, different travel time-frames, and different regulatory restrictions on travel. In addition, there are vastly different weights and anticipated routing between heavy-haul and overweight trucks. The 2002 heavy-haul analysis assumed that DOE would transfer the casks from rail cars to heavy-haul trucks at an intermodal side within Nevada (most likely at Caliente). FEIS Section 2.1.3.3.3., Page 2-54. Heavy-haul trucks would be starting from a specific location within Nevada and traveling one route repeatedly; overweight trucks will originate from outside the state and travel many different routes to reach the repository. The impacts of the heavy-haul plan are significant and substantially different from the overweight transport plan. In short, DOE is incorrect to assume that the impacts for a heavy-haul scenario are similar enough to the impacts of an overweight scenario that no new analysis is necessary for the new, overweight truck shipment plan.

The 2002 FEIS stated that some heavy-haul truck routes would need upgrades and improvements. Section 2.1.3.3.3.2, Page 2-57. Nevertheless, this analysis contained no detailed specificity with respect to critical matters of importance such as the feasibility, costs, funding, responsibility for, impacts of or timeline for construction of these road improvements. FEIS, Section 6.3.3 Page, 6-157; Section 6.3.3.1, Page 6-157; Section 2.1.3.3.3.2, Page 2-57. Additionally, a 2008 presentation by the Office of Logistics Management Transportation Program Review states that DOE "has no plans to provide funding for any upgrades to…national transportation infrastructure to support shipments." Attachment Four, Page 3. Given this statement, one can only assume that DOE has no plans to provide funding for upgrades to transportation infrastructure relating to overweight trucks. The attempt to avoid responsibility for mitigation is contrary to the provisions of NEPA.

Road improvements are critical to providing safer transport along highways for DOE shipments and for the public traveling on the highways. *See* Attachment Three. Given that the number of trucks transporting SNF/HLW is likely to higher than 2700 trucks and that the trucks will be routed through the Four Counties in an effort to avoid the urban area of Las Vegas, the transportation impacts on roads will be significant and substantial. *See* Attachment Two and Three, Paragraph 13. Most of the roads an overweight truck transporting SNF/HLW would utilize in Nevada are not interstate highways. Instead, the trucks will be traveling on narrow, rolling two lane blacktop, which do not have the same design criteria and are not as well maintained as interstate highways. Attachment Three, Paragraph 13. Most of these roads lack shoulders or areas

to pull off in case of emergency. There can be many miles between service stations and only limited cell phone coverage. In addition, overweight trucks will travel at a lower rate of speed, which, on a two lane highway such as Highway 95, can cause traffic to queue up behind the truck and/or pass in the on-coming traffic lane. Id. Overweight trucks shorten pavement life. Id. Finally, overweight trucks may have to travel up to 675 miles within Nevada to reach the repository and may be restricted to daylight travel only. Trucks will need a secure location for over-night parking. Attachment Three, Paragraph 16. In summary, transportation of overweight trucks will have significant and substantial impacts on the roads of the Four Counties and on the citizens of the Four Counties, who utilize those roads every single day. *See* Attachment Three. The citizens of the Four Counties fully rely on these roads for safe transportation. Despite all these environmental impacts, the Final SEIS does not address the impacts and contains no mitigation necessary to address the same when shipping via overweight trucks. Given the condition of the roads in Nevada and DOE's own acknowledgment, in the 2002 FEIS, that improvements are necessary to safe transport, an impact and mitigation analysis addressing this issue, for trucks of any size, must be included in the EIS documents.

e. Suggested Mitigation Measures.

While DOE is not required to follow any specific mitigation plan, they are required to consider mitigation. An objective evaluation shows there are significant and substantial impacts and the suggested mitigation measures include constructing passing lanes, increasing shoulder width, upgrading roadside design features, constructing climbing lanes, improving signage, upgrading intersections and constructing night-time layover locations. Attachment Three, Paragraph 14.

In conclusion, the DOE has not met its EIS burden of analysis for the transportation of SNF/HLW under NEPA and its applicable regulations. DOE is required to analyze its proposed action, alternatives to the action and methods to mitigate impacts in their EIS. NRC should not adopt the Final SEIS because significant and substantial new considerations render the EIS inadequate.

IV. Statement concerning whether the contention is a joint contention.

This a joint contention filed by Churchill, Esmeralda, Lander and Mineral Counties ("The Four Counties"). The parties will act by unanimous concurrence through Armstrong Teasdale, LLP.

1. Referenced Documents

1. Final 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 (DOE/EIS-0250F).
2. Final Supplemental 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 (DOE/EIS-0250F-S1).

3. Nation Academies, Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States 223 (National Academies Press 2006.

I. Joint Contention – The Nevada Counties of Churchill, Esmeralda, Lander, and Mineral (4NC-NEPA-2)

II. Insufficient analysis in Environmental Impact Statement of significant and substantial new considerations related to emergency response capacity within the Four Nevada Counties

III. Contention

1. Statement of issue of law or fact 2.309(f)(1)(i)

Applicant failed to adequately address significant and substantial considerations in the Final Supplemental Environmental Impact Statement (Final SEIS) regarding assessing local emergency response capacity related to the transportation of Spent Nuclear Fuel (SNF) and High Level Radioactive Waste (HLW), by truck, through the Nevada Counties of Churchill, Esmeralda, Lander and Mineral, as required by the National Environmental Policy Act (NEPA), as applied in the Nuclear Waste Policy Act (NWPA). 42 U.S.C. §4321 et seq. (2006) (setting out the requirements of NEPA); 42 U.S.C. §10247 (2006) (applying NEPA to the NRC process). A transportation incident involving SNF/HLW has the potential for significant and substantial effects on the human environment; DOE must provide an analysis of this proposed action and means to mitigate harmful impacts to the human environment in the EIS. *See* 40 C.F.R. § 1502.1 (2008). In addition, the Nuclear Regulatory Commission may adopt the EIS only if the document is complete and in compliance with NEPA and implementing regulations. 10 C.F.R. §51.109(a)(1)(2008). Because the Final SEIS, as submitted by DOE, is not complete with respect to the analysis of emergency response training, NRC erred in adopting these sections of the Final SEIS.

2. Explanation of basis 2.309(f)(1)(ii)

The document simply does not contain a sufficient, complete analysis of the potential actions and mitigation measures DOE should consider in order to make truck transport of SNF/HLW environmentally safe. DOE has a burden, under NEPA and applicable regulations, to analyze and consider both the proposed action and mitigation measures. Section 114 (f) Nuclear Waste Policy Act (2006). The purpose of the EIS is to provide a "full and fair discussion of environmental impacts" and mitigation measures, in order to ensure NRC and DOE have analyzed all of the environmental impacts of DOE's proposed action before NRC grants a license. 40 C.F.R. § 1502.1 (2008). DOE failed to meet its burden of analysis regarding both the proposed action and necessities for mitigation. These analyses are significant and substantial considerations to NRC's decision to grant a license, as NRC must determine, based on the content of the EIS, whether it is practicable to adopt the EIS. 10 C.F.R. § 51.109(c) (2008). The only way NRC can correctly make this determination is to either mandate that DOE further supplement the EIS or to condition the granting of a license on appropriate measures resolving these issues. 10 C.F.R. § 51.109(e)(1)-(3) (2008).

3. Issue is within scope of proceeding 2.309(f)(1)(iii)

The purpose of the EIS component of the application process is to provide clarity and guidance, as required by NEPA, on the environmental impacts of constructing the repository, delivering, and storing SNF/HLW at Yucca Mountain. *See* 40 C.F.R. § 1502.1 (2008); 10 C.F.R. § 1021.103 (adopting CEQ NEPA regulations for DOE actions). "Implicit in NEPA's demand that an agency prepare a detailed statement on 'any adverse environmental effects which cannot be avoided,' is an understanding that the EIS will discuss the extent to which adverse effects can be avoided." Roberston v. Methow Valley Citizens Council, 109 S.Ct. 1835, 1847 (1989). Thus, NEPA requires DOE to consider means to mitigate the "adverse effects" of transporting SNF/HLW by truck.

DOE has failed to meet the NEPA burden of analysis in the Final SEIS as the document does not include a substantial discussion of how DOE plans to mitigate the environmental impacts of an accident involving SNF/HLW being transported through Churchill, Esmeralda, Lander and Mineral Counties (the Four Counties). 42 U.S.C. §10175 (2006); Final SEIS Appendix H, Section H.6.1 and H.7, Page H-16 and H-18, 19. The truck transportation plan will create a funneling effect, in which trucks arriving at Yucca Mountain from throughout the country will converge in Nevada and through the Four Counties. In addition, it is likely that the number of trucks transporting SNF/HLW could be much higher than the 2700 trucks DOE estimated and, due to DOE's long-standing policy of precluding shipments of even low level waste through the Las Vegas Valley, there will be a concentration of overweight truck shipments through the Four Counties and a coinciding burden on emergency response resources. *See* Attachment One, Paragraph 7; Attachment Two, Paragraphs 7 and 8. Emergency responders, if properly trained, equipped and provided with operating budgets enabling them to respond to a SNF/HLW incident, have the potential to mitigate adverse environmental impacts flowing from an incident involving SNF/HLW traveling through their jurisdictions.

DOE itself stated, in the 2002 Final Environmental Impact Statement (FEIS), that DOE is responsible for developing policy and guidance for emergency planning, management, training, and response to an accident involving its shipments. FEIS, Appendix M, Section M.5.1, Page M-19. Thus, DOE has acknowledged, opened the door for and recognized the necessity of addressing mitigation measures, via full emergency response capability, including acquisition of equipment, hiring of and providing for the ongoing personnel and underwriting related costs concerning truck transportation. NRC should not allow DOE to subsequently deny the scope or materiality of this contention. Complete compliance with the NEPA statutory and regulatory mandates ensures that NRC will license the Repository only if DOE has comprehensive plans and procedures to transport SNF/HLW in a manner that will not unduly harm the human or natural environment. *See* 40 C.F.R. § 1502.1 (2008) (stating that the primary purpose of the EIS is to serve as an action-forcing device to insure… policies and goals defined in the Act are infused into ongoing programs and actions of the Federal Government).

4. Issue is material to findings NRC must make 2.309(f)(1)(v)

Section 114 (f) of the Nuclear Waste Policy Act and 42 U.S.C. § 10247, applying the requirements of NEPA to the Yucca Mountain repository licensing process, requires the Department of Energy to submit an Environmental Impact Statement, along with the License Application, to the Nuclear Regulatory Commission. NEPA and its implementing regulations require any agency proposing to undertake a "major federal action" to prepare an environmental impact statement considering both the impacts of the proposed action and the alternatives to the action. 42 U.S.C. § 4331 et seq. (2006). In addition, DOE is required by NEPA regulations to consider "means to mitigate adverse environmental impacts" in the EIS. 40 C.F.R. §1502.14 (2008).

Once DOE has prepared and submitted the EIS to the NRC, the NRC must determine whether to adopt the EIS or seek further supplementation of the EIS. 10 C.F.R. § 51.109(c)(1)-(2) (2008). Applicable regulations state that the NRC shall find it "practicable" to adopt any environmental impact statement unless significant and substantial new information or new considerations render the environmental impact statement inadequate. Id.

a. Department of Energy failed to provide a comprehensive analysis of mitigation in the form of emergency response availability in the Final SEIS as required of the agency by NEPA and NWPA.

NEPA regulations require DOE to consider the impact of its actions and alternatives, which would "avoid or minimize adverse impacts or enhance the quality of the human environment" and mitigation measures. 40 C.F.R. § 1502.1 (2008); 40 C.F.R. § 1502.14(f) (2008) (requiring DOE to include mitigation measures not already included in the proposed action or alternatives). DOE's proposed impact-causing action is to transport SNF/HLW by truck through the Four Counties. Based upon the aforementioned regulatory sections, DOE must address mitigation measures for this action.

DOE itself has demonstrated an acknowledgment of the importance and materiality of providing for emergency response training by including a limited discussion of providing funding for training in the Final SEIS. Final SEIS Appendix H, Section H.6 – H.7, Page H-16 – H-19. Obviously, DOE would not have included any information about emergency responder training and funding in the Final SEIS if the agency thought it immaterial to the EIS analysis. Unfortunately, the Final SEIS fails to analyze or provide enough information about emergency response planning to meet the NEPA burden of analysis. In the Final SEIS, DOE only discusses emergency responder training within the context and under the requirements of Section 180 (c) of the NWPA. Final SEIS Appendix H, Section H.7, Page H-19. Section 180 (c) is a very limited congressional mandate separate and apart from the burden of analysis DOE has under NEPA. *See* 42 U.S.C. § 10175 (2006).

The Final SEIS simply states the requirements of 180(c) and explains it plans to implement a limited training and technical assistance program, funneled through the

states, under this separate statute. Final SEIS Appendix H, Section H.7, Page H-19. NEPA requires DOE to perform a much fuller, more rigorous analysis. 40 C.F.R § 1502 et seq. (2008). While DOE is not required, by law, to formulate and adopt a complete mitigation plan, the U.S. Supreme Court has stated that the "omission of a reasonably complete discussion of possible mitigation measures would undermine the....function of NEPA." Robertson, 109 S.Ct. 1835, 1847 (1989). Regulations define "mitigation" as avoiding, minimizing, rectifying, reducing or compensating for impacts. 40 C.F.R. § 1508.20(a)-(e) (2008). DOE has stated it will provide some amount of technical assistance and training for counties, but that tribes and states have the "primary responsibility for the protection of the public and environment in their jurisdictions." Final SEIS Appendix H, Section H.6.1, Page H-16. DOE does not specify how it will distribute any funding or even whether DOE anticipates having sufficient funds to fully equip and train the Four Counties, through which DOE will transport SNF/HLW. DOE does not discuss how they will asses the needs of each county or how they will provide for communications interoperability between all of the departments responding to an incident. Given the plethora of issues related to mitigation DOE has not addressed, it is clear the mitigation analysis is inadequate.

The existing analysis is completely insufficient; NEPA requires concrete analysis and reasonably complete mitigation plans rather than nebulous statements of future intentions. DOE must explain its plans to assist and prepare local, Nevada county emergency responders for the likely occurrence that DOE experiences a transportation incident so that the impacts on the environment are limited.

b. The NRC erred in deciding to adopt the Final SEIS under applicable regulations for licensing the repository.

The Final SEIS, as submitted by DOE, does not meet the regulatory standards for adoption by the NRC. In a proceeding for the issuance of authorization to construct the Repository, the Commission is required to adopt the EIS prepared and submitted by the Secretary of Energy to the extent "practicable." 10 C.F.R. § 51.109(a)(1) (2008). The regulations state NRC shall find it "practicable" to adopt an environmental impact statement unless "significant and substantial... new considerations render the environmental impact statement inadequate." 10 C.F.R. § 51.109(c)(2) (2008). Per the March 20, 2008 letter to Mr. Martin Malsch and the October 22, 2008 Federal Register Notice, "substantive claims challenging the FEIS will be considered "new considerations" in the context of §51.109(c)." Attachment Five; Attachment Six. In short, the Commission should only accept the Final SEIS, as submitted, if it is not missing any "significant and substantial considerations" with respect to emergency management, which renders the document inadequate. Contrary to this regulatory standard, NRC adopted the Final SEIS provisions dealing with emergency response during the transportation of SNF/HLW.

The Final SEIS is incomplete and fails to meet the Commissioner's standard of acceptance under this regulatory section. The document does not adequately address many significant and substantial issues regarding emergency response. DOE does not

analyze or explain at all how it will actually support local emergency responders in any specific, concrete manner. This is a glaring inadequacy in the Final SEIS. Granting a license by the NRC will result in a high number of overweight trucks and rail cars transporting SNF/HLW through the Four Counties, any of which could be involved in an accident harmful to the environment; DOE must give reasonable assurance, in the EIS documents, that the agency plans to mitigate the impacts of this proposed transportation action.

In summary, the Final SEIS is insufficient and, thus, the Nuclear Regulatory Commission's determination to adopt the Environmental Impact Statements with respect to emergency response issues is flawed. In order to comply with statutory and regulatory burdens of adoption, DOE or NRC must analyze the complex risks and impacts to the human environment by clearly addressing the obvious needs for adequate support and response capability of emergency responders.

5. Statement of alleged facts or opinions and references to be relied upon and references to specific portions of application petitioner disputes 2.309(f)(1)(v)-(vi)

DOE, in the Final SEIS, has not addressed the issue of readiness assessment and training for emergency responders in the counties through which DOE will transport SNF/HLW by truck shipment. DOE simply states that it will comply with 180 (c) requirements, which is wholly inadequate in terms of meeting their burden under NEPA. DOE must address this issue because the quick, capable performance of emergency responders will significantly effect the extent of an impact on the environment that will result from a DOE transportation incident.

The majority of the areas where DOE will be transporting SNF/HLW are rural and isolated. The roads in the Four Counties are almost exclusively windy, rolling, two lane highways with no shoulders and no areas to pull off the road in case of an emergency. In addition, most road areas have limited to no cell phone coverage. In short, the roads are not interstate highways. The road infrastructure itself in rural Nevada is quite limited, which means that alternative routes are not readily available. And, finally, the Four Counties have minimal to no voice or data interoperability amongst themselves or with any other government responders. Attachment Seven, Paragraph 5; Attachment Eight through Eleven, Paragraph 8. As a result of all of these factors, a simple traffic accident involving an overweight truck, let alone something more serious, such as an issue involving the security or radiological integrity of a canister, has the potential to cause a number of major logistical and environmental safety issue for emergency responders. However, if the emergency responders are provided with the necessary equipment, personnel and ongoing operating budgets, the impacts of a transportation accident may be less severe. *See* Attachment Seven, Paragraph 5 b. DOE must plan to equip police, fireman and EMTs because it not only protects the DOE shipments, but also mitigates harmful impacts on the environment and the public. DOE can and must address the burden of such mitigation, inasmuch as the Four Counties can not afford to do so.

DOE states that the primary responsibility for protection of public and the environment lies with the states and tribes along the shipping route. Final SEIS Appendix H, Section H.6.1, Page H-16. While DOE is accurate in saying that local jurisdictions will bear the burden of responding to a SNF/HLW transportation incident, DOE is not correct, in this instance, in saying that the "primary responsibility" lies with states and tribes." Final SEIS Appendix H, Section H.6.1, Page H-16. In reality, the individual counties and communities will bear the full burden and responsibility of responding to any emergency incident within their jurisdiction. DOE, as part of the NEPA component of the license application process, has the burden of analyzing its actions and mitigating impacts on the environment DOE may cause by its proposed action. 40 C.F.R. §1502 et seq. (2008). DOE itself stated, in the 2002 Final Environmental Impact Statement (FEIS), that DOE is "responsible for developing policy and guidance for emergency planning, management, training, and response to an accident involving its shipments." FEIS, Appendix M, Section M.5.1, Page M-19.

Currently, the Four Counties have no voice and data interoperability capability between emergency responders and their related facilities, between counties, between the state and counties, or between local emergency responders and any U.S. Government facilities. Attachment Seven, Paragraph 5; Attachment Eight through Eleven, Paragraph 8. The Nevada State Legislative Commissions Audit Subcommittee report and the Nevada Homeland Security Commission both found that there is presently minimal voice or data interoperability, but there is a need for a rapidly deployed interoperable communication system and, without this interoperable communication network, Nevada is not ready for shipments of hazardous materials. Attachment Seven, Paragraph 5. Voice and data interoperability is a vital, critical, necessary and required component of effective protection of the health and welfare of the public in connection with shipments. Attachments Eight through Eleven, Paragraph 8. While interoperability is a critical and necessary, the estimated cost ($7 Million for implementation, $2.5 to $3 Million for maintenance) would pose an insurmountable financial and logistical burden on the Four Counties should they have to bear responsibility independent of DOE assistance. Attachment Eight through Eleven, Paragraphs 8 and 9. Mineral & Esmeralda Counties provide examples of why this is issue must be addressed by DOE. Mineral County has radiological detection equipment available, however, they have received no assistance on how to calibrate or use it and there is no program in place to check that such equipment is maintained in working order over the long term. "Preliminary Assessment of Emergency Response Capabilities for Proposed Shipments to Yucca Mountain," Page 5 (LSN MNE000000006). Esmeralda County, Nevada's fire protection and EMS is staffed solely by volunteers. "Esmeralda County Repository Oversight Program Baseline 2007," Page 33 (LSN ESM000000018). Due to a reduction in volunteers in emergency services and difficulties in scheduling training, Esmeralda County has experienced a decrease in ability to respond to Emergencies involving hazardous materials. Id. at 33-34.

The Four Counties have each estimated their needs in terms of providing for the additional personal, equipment, maintenance and operation due to the transportation of SNF/HLW through their counties. In total, the Four Counties will accrue an initial capital cost, in today's dollars, of $15,963,500.00. Attachments Eight through Eleven, Paragraphs 5 through 7. In total, the annual operating costs for the required additional

personnel, in today's dollars, will be $4,656,0000.00 Id. The total annual maintenance cost, in today's dollars, will be $420,263.00. Id. The total, in today's dollars, annual operation cost will be $463,000.00 and the total annual replacement cost will be $1,680,705.00. Id.

As is obvious from these figures and attachments, preparation for and responding to a SNF/HLW accident will be extraordinarily burdensome to the Four Counties. It must be recognized that the Four Counties consist of small communities, with a struggling economy and limited tax base. They are unable to shoulder the costs associated with mitigation of the obvious environmental impacts of transporting HLW/SNF through their counties. One can see from these aforementioned representative examples and attachments, the counties in Nevada will encounter significant difficulties in adequately managing an emergency involving SNF/HLW without support from DOE. Despite local responders' present lack of preparation and fiscal wherewithal, DOE will, by their own acknowledgment, be depending on these same entities to manage any incident involving a truck loaded with SNF/HLW. Final SEIS Appendix H, Section H.6.1, Page H-16. DOE must consider a strategy to provide local emergency response training/support as part of its mitigation analysis.

DOE states that they would provide technical advice and assistance at the request of civil authorities. Final SEIS Appendix H, Section H.6.1, Page H-16. However, DOE provides only very limited details on how this will occur before or during an emergency. DOE plans to provide some assistance through the Radiological Assistance Program Regional Coordinator (RAP), which is available 24 hours a day, 365 days a year, with teams that can respond to an incident. Final SEIS Appendix H, Section H.6.1, Page H-16. However, the RAP normally arrives "within four to six hours after notification." Attachment Twelve, Page 3. This leaves four to six hours wherein Nevada emergency responders will have to rely on their own training, equipment and personnel to respond to any and every situation that may arise. While the support of the RAP is welcome, given their protracted response time, DOE can not substitute their services for identifying and considering the training, personnel and equipment needs of Nevada county emergency responders. To do otherwise will leave a large window of time wherein an improperly managed incident could cause severe damage to the environment, the health and the safety of the citizens of the Four Counties.

The Final SEIS also states that planning grants (established under Section 180 (c)) will only be available four years prior to the commencement of shipments through any jurisdiction in Nevada. Final SEIS Appendix H, Section H.7, Page H-19. DOE is proposing a very condensed time frame for the Four Counties to assess their needs, plan for training activities, procure resources and actually conduct all of the necessary training before the first shipments commence. The National Academies recommends providing "at least a base level of assistance at the earliest possible date." National Academies, Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States, 255 (National Academies Press 2006). While more than three to four years before the first shipments may be too early to train specific emergency responders, DOE could focus its efforts on "long-term activities such as planning for equipment procurements, calibrations, upgrades, and replacement of

radiation detection instruments used by emergency responders." Id. at 256. Starting early will also give DOE time to resolve any unanticipated issues such that DOE can transport SNF/HLW without unduly harming the environment in the case of an emergency. Commencing emergency planning as soon as possible is the best method of ensuring that DOE will have the time, with full assurances of necessary future funding, and have actually, adequately prepared all of the counties in Nevada before the first shipment occurs.

Finally, DOE must explain in greater, clearer detail how it plans to implement its emergency response assistance programs. DOE states that it will work with "states and tribes to evaluate current preparedness for safe routine transportation and emergency response and will provide funding as appropriate to ensure that state, tribal, and local officials are prepared for such shipments." Final SEIS Appendix H, Section H.7, Page H-19. One might infer that DOE intends to fund equipment and operating costs. DOE also states that it will provide the grants but, leave it to the "States and tribes" to coordinate with local public officials and describe how they (the States and tribes) would use the grants to provide training to local public safety officials. Final SEIS at H-19. This statement is not sufficient to fulfill DOE's burden of analysis and mitigation of the impacts of transporting SNF/HLW. Training is only one component of the NEPA burden of analysis for mitigation and DOE should be focusing their analysis on the needs of local and tribal governments, rather than merely providing a block grant to the state. A September 2008 report by the Nevada State Legislature Audit Subcommittee on the capabilities of Nevada's Department of Emergency Management Division (DEM) found that DEM "has not demonstrated adequate oversight of or coordination with other entities in preparation of their emergency operation plans or emergency response plans," DEM has a burden under Federal Homeland Security law to coordinate emergency plans among the state, political subdivisions and tribes, but could not locate plans for 53 of 95 entities, and DEM did not have a process to track emergency equipment that can minimize the impact of a disaster. Attachment Seven, Paragraph 4. Clearly, the state of Nevada is not capable or dependable in preparing emergency responders for SNF/HLW incidents. Regardless of the adequacy of state emergency response preparation, local responders, not states, will be the parties primarily responding to an incident. Yet, DOE has not provided any information or quality assurance that local responders will receive the technical support and training necessary to mitigate impacts of any accident. DOE, as the agency with experience handling and transporting SNF/HLW must take a pro-active role in this process in order to ensure local communities have a solid understanding of and the personnel and tools to fulfill their burdens and responsibilities in responding to a SNF/HLW incident are by augmenting the EIS in order to meet the requirements for a NEPA analysis. Implementing this mitigation tactic will limit the harmful environmental impacts flowing from a SNF/HLW transportation accident.

In summary, DOE clearly has not met its burden under NEPA to analyze its proposed action and provide mitigation. One very obvious way in which DOE must mitigate the impacts of its proposed action of transporting SNF/HLW through Nevada is to provide technical assistance and fully support local jurisdictions so that they can effectively respond and contain the harmful environmental impacts of any accidents. DOE's statement in the Final SEIS that it plans to comply with 180 (c) is insufficient

because the discussion is limited to generalities of complying with a separate, very limited statutory provision, rather than providing concrete details and analysis required by NEPA. NRC should not adopt the Final SEIS, as currently written, because significant and substantial considerations regarding emergency responders render these portions of the Final SEIS inadequate.

IV. Statement concerning whether the contention is a joint contention.

This is a joint contention filed by Churchill, Esmeralda, Lander and Mineral Counties (The Four Counties). The parties will act by unanimous concurrence through Armstrong Teasdale, LLP.

1. Referenced documents

1. Final Supplemental 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 (DOE/EIS-0250F-S1).
2. Final 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 (DOE/EIS-0250F).
3. National Academies, Going the Distance? The Safe Transport of Spent Nuclear Fuel and High-Level Radioactive Waste in the United States, 255 (National Academies Press 2006).
4. Mineral County Office of Nuclear Projects, "Preliminary Assessment of Emergency Response Capabilities for Proposed Shipments to Yucca Mountain," December 1, 2003, LSN Accession Number MNE000000006.
5. Esmeralda Repository Oversight Program Office & NWOP Consulting, Inc.,"Esmeralda County Repository Oversight Program Baseline 2007," 3/30/2008, LSN Accession Number ESM000000018.

I. Joint Contention – The Nevada Counties of Churchill, Esmeralda, Lander, and Mineral (4NC-NEPA-3)

II. Insufficient analysis in Environmental Impact Statement of significant & substantial new considerations related to selection of SNF transportation container, which renders Environmental Impact Statement inadequate.

III. Contention

1. Statement of issue of law or fact 2.309(f)(1)(i)

Applicant failed to effectively address significant and substantial new considerations in the Final Supplemental Environmental Impact Statement (Final SEIS) related to the differing impacts of alternative types of transportation canisters used upon worker safety estimates at the Yucca Mountain Repository as required by the National Environmental Policy Act (NEPA), as applied in the Nuclear Waste Policy Act. 42 U.S.C. § 4321 et seq. (2006) (setting out the requirements of NEPA); 42 U.S.C. §10247 (2006) (applying NEPA to the NRC process). Because the type of shipping canisters selected by commercial generators affects whether fuel must be repackaged before emplacement and repackaging can increase exposure to radiation, the varying effects of the alternative containers on the human environment must be considered. DOE must provide an analysis of this variable and means to mitigate harmful impacts to the human environment in the EIS. *See* 40 C.F.R. § 1502.1 (2008). Furthermore, the Nuclear Regulatory commission may adopt the EIS only if the document is complete and in compliance with NEPA and its implementing regulations. 10 C.F.R. § 51.109(a)(1) (2008). Because the Final SEIS, as submitted by DOE, is not complete with respect to the impacts of differing Spent Nuclear Fuel (SNF) canister utilization estimates and correlating impacts on worker safety, NRC erred in adopting these sections of the Final SEIS.

2. Explanation of basis 2.309(f)(1)(ii)

The document does not contain a sufficiently complete analysis of the distinctly different exposure risks to Yucca Mountain Repository workers resulting from DOE's proposed action to transport SNF in TADs and DPCs because DOE does not correctly estimate the numbers of each of these two distinctly different canisters, which commercial generators will utilize in shipping SNF to Yucca Mountain. Specifically, the quantities of DPCs are substantially under-estimated in DOE's evaluation, which will result in higher worker radiation risks as a consequence of the necessary additional handling related to repackaging. DOE has a burden, under NEPA and applicable regulations, to correctly analyze the proposed action, alternatives and mitigation measures. Section 114 (f) Nuclear Waste Policy Act (2006); 40 C.F.R. § 1502.1 (2008). The purpose of this analysis is to provide a "full and fair discussion of environmental impacts," in order to ensure NRC and DOE have analyzed all of the environmental impacts of DOE's proposed action before NRC grants a license. § 1502.1 (2008). DOE failed to meet its burden of analysis regarding both the proposed action (the quantities of SNF to be placed, respectively, in TADs & DPCs) and the resulting impacts on worker

safety at the Repository. These analyses are significant and substantial considerations to NRC's decision to grant a license, as NRC must determine, based on the content of the EIS, whether it is practicable to adopt the EIS. 10 C.F.R. § 51.109(c) (2008). The only way NRC can correctly make this determination is to require that the EIS be complete and thorough with respect to the environmental and worker safety impacts resulting as a consequence of canister handling at the repository by either mandating that DOE further supplement the EIS, or conditioning the granting of a license on appropriate measures resolving these issues. 10 C.F.R. § 51.109(e)(1)-(3) (2008).

3. Issue is within scope of proceeding 2.309(f)(1)(iii)

The purpose of the EIS component of the application process is to provide clarity, guidance and disclosure, as required by NEPA, on the environmental impacts of constructing the repository, delivering, storing and disposing of SNF/HLW at the Yucca Mountain Repository. *See* 40 C.F.R. §1502.1 (2008); 10 C.F.R. § 1021.103 (adopting CEQ NEPA regulations for DOE actions). "Implicit in NEPA's demand that an agency prepare a detailed statement on "any adverse environmental effects which cannot be avoided," is an understanding that the EIS will discuss the extent to which adverse effects can be avoided." Robertson v. Methow Valley Citizens Council, 109 S.Ct. 1835, 1847 (1989). Thus, NEPA does require DOE to consider the impacts and alternatives to the "adverse effects" of an increased reliance on DPCs.

The type of canister DOE will receive at Yucca Mountain and the resulting impacts on the environment and workers at the site are clearly a "major process" of the repository, with significant and substantial impacts on the environment, requiring accurate analysis. In addition, this issue is within the scope of this proceeding; DOE included an inaccurate analysis of the percentage of both TADs and DPCs to be shipped to the Repository, as well as resulting estimates of health and safety impacts to workers and to members of the public for each repository analytical period in the Final SEIS. Final SEIS, Section S.2.3.1, Page S-13; Section S.4.1.7, Page S-34; Section 4.1.7.2.3, Page 4-64 & Table 4-23, Page 4-66. The impacts on worker safety are of particular concern to Churchill, Esmeralda, Mineral and Lander Counties (the Four Counties) because, by virtue of their proximity to the Repository, residents of each of the Four Counties are likely to be employed at the Repository during the operations period. These employees can reasonably be expected to handle SNF/HLW during the course of their employment and, therefore, be directly impacted in terms of both their personal health and that of the surrounding environment, by the aforementioned concerns resulting from what type of container DOE receives SNF in.

Complete compliance with the NEPA statutory and regulatory mandates ensures that NRC will license the Repository only if DOE has comprehensive plans and procedures to utilize SNF transport containers in a manner that will not unduly harm the human or natural environment. *See* 40 C.F.R. §1502.1 (2008) (stating that the primary purpose of the EIS is to serve as an action-forcing device to insure...policies and goals defined in the Act are infused into ongoing programs and actions of the Federal Government).

4. Issue is material to findings NRC must make 2.309(f)(1)(v)

Section 114 (f) of the Nuclear Waste Policy Act and 42 U.S.C. §10247 (2006), applying the requirements of NEPA to the Yucca Mountain repository licensing process, require the Department of Energy to submit an Environmental Impact Statement, along with the License Application, to the Nuclear Regulatory Commission. NEPA and its implementing regulations require any agency proposing to undertake a "major federal action" to prepare an environmental impact statement considering both the impacts of the proposed action and the alternatives to the action. 42 U.S.C. § 4331 et seq. (2006). In addition, DOE is required by NEPA regulations to consider "means to mitigate adverse environmental impacts" in the EIS. 40 C.F.R. § 1502.14 (2008).

Once DOE has prepared and submitted the EIS to the NRC, the NRC must determine whether to adopt the EIS or seek further supplementation of the EIS. 10 C.F.R. § 51.109(c)(1)-(2) (2008). Applicable regulations state that the NRC shall find it "practicable" to adopt any environmental impact statement unless "significant and substantial new considerations render such environmental impact statement inadequate." Id.

a. Department of Energy failed to provide a comprehensive analysis of the impacts of the realistic proportions of differing TAD and DPC canister utilization in the Final SEIS, as required of the agency by NEPA and NWPA.

The Final SEIS, submitted by the DOE, does not meet the Agency's regulatory burden of analysis for an EIS. The document should contain a comprehensive analysis of both the proposed action and alternatives to the proposed action, as well as mitigation measures. 42 C.F.R. § 1502.1 (2008); 40 C.F.R. § 1502.14(f) (2008). The EIS fails to analyze or provide complete information about the proposed action of shipping SNF by TADs or how DOE will actually put TADs into use from the outset of repository operations. The percentage of SNF shipped in TADs versus DPCs will have a significant and substantial impact on worker safety/exposure and, correspondingly, the accuracy of DOE's estimated health impacts to workers during operations at the Repository.

The Final SEIS fails to fully address or analyze the repository transportation plan: the differing consequences of the types and numbers of containers DOE and commercial generators will utilize for shipments of SNF. The Final SEIS included an estimate of 307 DPCs and 6,499 TADs shipped to the Repository by generators under a 90% TAD utilization rate or 310 DPCs and 5,526 TADs under at 75% TAD utilization rate. Final SEIS Appendix A, Section A.2.1, Page A-3. This estimate of DPC usage is arbitrary and, in all likelihood, unrealistically low. DOE has reached no agreement related to the use of TADS with any of the commercial generators, including responsibility for purchasing or timeframe for utilization of TADs. Also, DOE has not addressed whether commercial generators will repackage SNF already packaged and in dry storage. Commercial Generators are much more likely to ship a significantly greater number of DPCs than DOE estimates in the Final SEIS. DOE needs to address an increased incidence of DPCs

usage in the Final SEIS since DOE will likely need to repackage DPCs at the repository, increasing environmental and worker radiation exposure. Attachment Sixteen. DOE does not address these issues separately or in conjunction with its scrutiny of worker safety.

DOE must provide an analysis of how selection of transportation containers by commercial generators and DOE will change or impact their worker safety/exposure estimates. Otherwise, the accuracy of EIS analysis of the environmental impacts is, due to arbitrary assumptions made by DOE, unreliable at best. In short, without this scrutiny of how DOE will ensure utilization of TADs at the 75 to 90% rate, DOE has not sufficiently analyzed the full range of impacts of their proposed action upon the Repository employees handling the material, including residents of the Four Counties.

b. The NRC erred in deciding to adopt the Final SEIS under applicable regulations for licensing the repository.

The Final SEIS, as submitted by the DOE, does not meet the regulatory standards for adoption by the NRC. In a proceeding for the issuance of authorization to construct the Repository, the Commission is required to adopt the environmental impact statement prepared and submitted by the Secretary of Energy to the extent "practicable." 10 C.F.R. § 51.109(a)(1) (2008). The regulations state NRC shall find it "practicable" to adopt an environmental impact statement unless the action proposed to be taken by the Commission differs from the action proposed in the license application and the difference significantly affect the quality of the human environment or "significant and substantial new considerations render the environmental impact statement inadequate." 10 C.F.R. § 51.109(c)(1)-(2) (2008). Per the March 20, 2008 letter to Mr. Martin Malsch and the October 22, 2008 Federal Register Notice, "substantive claims challenging the FEIS will be considered "new considerations" in the context of § 51.109 (c)." Attachment Five; Attachment Six. In short, the Commission should only accept the Final SEIS, as submitted, if it is not missing any significant and substantial considerations with respect to impacts on worker safety and the environment flowing from transportation containers selected. Contrary to this regulatory standard, NRC adopted the Final SEIS provisions dealing with this issue.

The Final SEIS, submitted by the Secretary of Energy, is incomplete and fails to meet the Commissioner's standard of acceptance under this regulatory section. The document does not adequately address the environmental and worker safety impacts resulting from transportation container selection. In short, the Final SEIS submitted by the DOE is insufficient and, thus, the Nuclear Regulatory Commission's determination to adopt the Environmental Impact Statement with respect to this issue is incorrect. In order to comply with statutory and regulatory burdens of adoption, DOE or NRC must analyze the complex issues presented by receiving SNF at the Repository, in DPCs, at a more realistic number.

5. Statement of alleged facts or opinions and references to be relied upon and references to specific portions of application petitioner disputes 2.309(f)(1)(v)-(vi)

DOE has not fulfilled its NEPA obligations because it has not completed an accurate and realistic analysis of the varying impacts resulting from differing container selection on worker safety and the environment. If DOE's predictions about TAD utilization by generators are inaccurate, than DOE's estimates on the environmental and worker safety impacts at the repository are also inaccurate. In order to comply with the statutory and regulatory burden of analysis, NRC must require that DOE include an analysis of the environmental impacts of repackaging waste due to significantly higher numbers of DPCs being sent to the Repository than the figures in the Final SEIS.

The Final SEIS states that DOE will ship approximately 90% of the shipments of SNF in TADs (although DOE also included an analysis of 75% TAD usage in Appendix A of the Final SEIS). Final SEIS Section S.2.3.1, Page S-13 and Section 2.1.1, Page 2-8. However, DOE does not include any specific information regarding how it reached this estimate or why 90% TAD is a reasonable estimate. DOE currently has no agreement in place with any SNF generators regarding who will pay for the TADs or requiring generators to utilize TADs when shipping SNF to the Repository. Attachment Sixteen, Paragraph 6 (a)(i); Attachment Fourteen. In fact, there is reliable information calling this 90% figure into question. Rod McCullum, of the Nuclear Energy Institute, stated at the WIEB meeting on April 23, 2008, that "while utilities generally support the TAD concept, they do not intend to purchase (and load) TADS until... 2017 or later. Meanwhile, SNF... will be placed in dual purpose canisters (DPCs), which utilities do not intend to reload to TADs for shipment." Id. In short, between present day and 2017, commercial generators will be loading DPCs and, by 2017, more than 25% of the SNF will already be loaded into DPCs. Because of the exorbitant expense of repacking, commercial generators are not likely to be willing to repackage all of the SNF already in DPCs before sending the SNF to the repository. Id. Thus, the actual number of DPCs that DOE will have to reload at the repository will probably be significantly and substantially higher than DOE's estimate of 307 DPCs. The industry estimates that by the year 2020 2100 DPCs will be loaded. Attachment Sixteen; Attachment Fifteen. EPRI estimates the number of DPCs requiring repackaging may be as high as 2,155 DPCs. Attachment Sixteen; Attachment Thirteen, Page 4-1. Based on the increase in DPC usage and repackaging, there will be a correlating underestimation of the worker/environmental safety hazards in the Final SEIS. Id.

DOE argues in Appendix A of the Final SEIS that an increase in the number of DPC containers received and repackaged at the repository will have no measureable impact on public health or worker safety. Final SEIS Appendix A, Section A.2.2, Page A-4. DOE states that a the reduction in the number of Canister Receipt and Closure facilities used to handle TADs would offset the external radiation impact to workers from the additional Wet Handling Facility used to handle DPCs. Id. This statement is misleading at best. *See* Attachment Sixteen, Paragraph 10. The total individual dose (rem) for a surface worker at the Wet Handling Facility is 9.3. Final SEIS Appendix D, Section D.4.3., Page D-22. The total individual dose (rem) for a surface worker at the Canister Receipt and Closure Facility is 6.8. Id. An increase in the number of DPCs received at the facility will result in an increase in the number of employees handling DPCs at the Wet Handling Facility, all of whom will be exposed to radiation at an increased level over that of a worker at the Canister Receipt and Closure Facility. *See*

Attachment Sixteen, Paragraph 10. DOE must discuss this varying level of impact on worker safety as part of its NEPA analysis.

In Conclusion, DOE has not met its EIS burden of analysis for the impact of DPC containers on worker safety and the environment under NEPA and its applicable regulations. DOE is required to realistically analyze its proposed action, alternatives to the action and methods to mitigate impacts in their EIS. NRC should not adopt the EIS because significant and substantial considerations about whether TADs will actually be utilized in the percentage DOE assumes are in the Final SEIS are arbitrary and inaccurate and renders the document inadequate.

IV. Statement concerning whether the contention is a joint contention.

This is a joint contention filed by Churchill, Esmeralda, Lander and Mineral Counties ("The Four Counties"). The parties will act by unanimous concurrence through Armstrong Teasdale, LLP.

1. Referenced Documents

1. Final Supplemental 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 (DOE/EIS-0250F-S1).

I. Joint Contention – Nevada Counties of Churchill, Esmeralda, Lander, and Mineral (4NC-SAFETY-1)

II. Insufficient analysis in the License Application and SAR of transportation container usage and correlating impacts on worker safety.

III. Contention

1. Statement of issue of law or fact 2.309(f)(1)(i)

The Department of Energy (DOE) is required to include, in the Safety Analysis Report (SAR), a description of the "processes" of the site that might affect the design of the geologic repository operations area and performance of the geologic repository. 10 C.F.R. § 63.21(c)(1) (2008). The type of container DOE will receive at the repository and the resulting impact of that shipping container selection on Repository worker safety is one such "process" DOE must analyze in the SAR. The Nuclear Regulatory Commission (NRC) may only authorize construction of the repository at Yucca Mountain if there is "reasonable assurance" that the radioactive material can be "received and possessed in a geologic repository operations area...without unreasonable risk to the health and safety of the public." 10 C.F.R. § 63.31(a)(3)(vi) (2008). In order to make such a conclusion, the Commission shall consider whether "DOE's proposed operating procedures to protect health and to minimize danger to life or property are adequate." 10 C.F.R. § 63.31(a)(3)(vi) (2008). Thus, NRC should consider the impacts on worker safety resulting from an accurate estimate of the type and number of canisters used to ship SNF to the repository.

2. Explanation of basis 2.309(f)(1)(ii)

DOE failed to effectively address key issues regarding the packaging of SNF in the Safety Analysis Report (SAR). The Department is required to address the issues critical to the safe operation of the repository under 10 C.F.R. § 63.21(c)(1)(2008) and NRC is required to consider these issues before granting authorization under 10 C.F.R. § 63.31(a)(3)(vi) (2008). One such issue critical to the safe operation of the repository is the canister design utilized in shipping SNF to Yucca Mountain. As DOE notes in the SAR, TADs "minimize handling of...SNF at the repository" because they do not need to be repackaged. Conversely, DPCs increase handling and worker exposure because DOE must repackage SNF received in DPCs at the repository. SAR Chapter 1, Section 1, Page 1-2. DOE proposes shipping 90% of SNF in TADs, but significant factors call into question whether this estimate is realistic or practical. In fact, it is more likely that Yucca Mountain will receive SNF in TADs at a significantly smaller percentage. The SAR does not address many of the issues related to the use of TADs, such as who will purchase the TADs and arbitrarily assumes that commercial generators will repackage significant quantities of fuel, currently held in DPCs and to be packaged in DPCs during future years, into TADs before shipping. Due to these uncertainties, DOE has failed to effectively address this key process.

3. Issue is within scope of proceeding 2.309(f)(1)(iii)

The NRC must make a determination that the repository can operate in a manner that does not cause unreasonable risk to the health and safety of the public. 10 C.F.R. § 63.31(a)(3)(vi) (2008). In order to make this determination, DOE has the responsibility of providing all the requisite information and fully analyzing all of the processes related to operating the Yucca Mountain Repository safely. DOE anticipates packaging and handling SNF received at the repository in a specific manner (90% TAD, 10% DPC). *See* SAR Chapter 1, Section 1.2.1, Page 1.2.1-3. Therefore, NRC must consider whether DOE has provided reasonable assurance on how the 90% TAD-based plan will likely come to fruition because, if it will not, than DOE has failed to meet their burden of analysis. 10 C.F.R. § 63.31(a)(3)(vi) (2008). Due to DOE's obvious failure to fully analyze this important aspect of its plan to transport SNF in TADs, with only a 10% supplementation by DPCs, neither NRC nor any interested parties can determine whether the DOE plan provides reasonable assurance of no unreasonable risk to health and safety of the public.

4. Issue is material to findings NRC must make 2.309(f)(1)(v)

The DOE must include, in the SAR, a description of the processes of the site that might affect the design of the geologic repository. 10 C.F.R. § 63.21(c)(1) (2008). In addition, before NRC can issue a license for construction of the repository, there must be "reasonable assurance" that radioactive material can be "received and possessed in a geological repository operation area...without unreasonable risk to health and safety to the public." 10 C.F.R. §63.31(a)(3)(vi) (2008). In short, DOE must write the SAR in a manner that provides assurance that DOE has analyzed all aspects of the Yucca Mountain Projects from a safety standpoint. Unfortunately, DOE has not done so. The SAR states that the repository "surface facilities are based on the concept of a 90% TAD canistered approach for handling commercial SNF." SAR Chapter 1, Section 1, Page 1-2. However, a number of uncertainties surround whether DOE will actually be able to follow through with their TAD-based plan. If DOE can not meet the 90% TAD target, the result will be DOE repackaging a significantly higher amount of SNF at the repository. If DOE does have to repackage a higher proportion of the SNF than the SAR anticipates, the impacts on worker safety would be significant. Due to the deficient analysis of the feasibility of implementing the use of TADs and DPCs, the Commission simply does not have "reasonable assurance" from DOE that the Repository can receive SNF in a manner that minimizes harm to workers at the repository, many of whom are likely to be citizens of the Four Counties.

5. Statement of alleged facts or opinions and references to be relied upon and references to specific portions of application petitioner disputes 2.309(f)(1)(v)-(vi)

DOE has not fulfilled its NEPA obligations because it has not completed an accurate analysis of the impact of the differing type and number of containers received at the repository on worker safety at the repository. If DOE's predictions as to the percentage of TAD utilization in shipping by commercial generators are

inaccurate, than DOE's estimates on the environmental and worker safety impacts from receipt of SNF at the repository will also be inaccurate. In order to comply with the statutory and regulatory burden of analysis, DOE and/or NRC must include an analysis of the safety impacts of repackaging waste at the repository under a scenario in which DOE receives significantly higher numbers of DPCs at the Repository than the 10% figure set out in the Final SEIS.

The SAR states that generators will package approximately 90% of the shipments of SNF in TADs. SAR Chapter 1, Section 1.2.1, Page 1.2.1-4. However, DOE does not include any specific information regarding how it reached this estimate or why 90% TAD is a reasonable estimate. DOE currently has no agreement in place with any SNF generators regarding who will pay for the TADs or whether generators plan to use TADs when shipping SNF to the Repository. Attachment Sixteen, Paragraph 6(a)(i). In fact, there is reliable information calling this 90% estimate into question. Rod McCullum of the Nuclear Energy Institute stated at the WIEB meeting on April 23, 2008 that "while utilities generally support the TAD concept, they do not intend to purchase (and load) TADS until... 2017 or later. Meanwhile...SNF will be placed in dual purpose canisters (DPCs), which utilities do not intend to reload to TADs for shipment." Attachment Sixteen, Paragraph 6(a)(i); Attachment Fourteen. In short, between present day and 2017, commercial generators will be loading DPCs and, by 2017, more than 10% of the SNF will already be loaded into DPCs. Because of the exorbitant expense of repacking, commercial generators are not likely to be willing to repackage all of the SNF already in DPCs before sending the SNF to the repository. Id. Thus, it is probable that the actual number of DPCs that DOE will have to handle and reload at the repository will be significantly and substantially higher than DOE's estimate of 307 DPCs. In fact, EPRI estimates the number of DPCs requiring repackaging may be as high as 2,155 DPCs. Attachment Sixteen; Attachment Thirteen, Page 4-1 Based on the increase in DPC usage and repackaging, there will be a correlating increase in the worker safety hazards, which is not fully or adequately addressed by the SAR. Attachment Sixteen, Paragraph 10.

In Conclusion, DOE has not met its burden of accurate analysis for the impact of DPC containers on worker safety and the environment under the applicable regulations at the repository. DOE is required to describe the "processes" of the site that affect the design and performance of the repository and the type of container DOE will receive at the repository is one such "process." And, NRC may only authorize construction if there is "reasonable assurance" that SNF can be received without unreasonable risk to health and safety of the public. NRC

IV. Statement concerning whether the contention is a joint contention.

This a joint contention filed by Churchill, Esmeralda, Lander and Mineral Counties ("The Four Counties"). The parties will act by unanimous concurrence through Armstrong Teasdale, LLP.

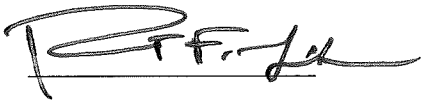
1. Referenced documents

a. Yucca Mountain Repository License Application, Safety Analysis Report. DOE/RW-0573 REV 0. 2008.

C. CONCLUSION

The Four Nevada Counties request that its petition to intervene be granted and that its specific contentions proposed herein be admitted for hearing.

Respectfully Submitted,



Robert F. List

Senior Counsel
Armstrong Teasdale LLP
1975 Village Center Circle
Suite 140
Las Vegas, NV
89134

(702)733-6700

Dated in Las Vegas, Nevada
This 19th day of December 2008

ATTACHMENT 1

AFFIDAVIT OF ENGELBRECHT VON TIESENHAUSEN

I, Engelbrecht von Tiesenhausen, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Las Vegas, Nevada.

2. My formal education consists of the following: A Bachelor of Applied Science from the University of British Columbia and a Master in Business Administration from Pepperdine University

3. My professional employment experience with respect to nuclear waste disposal, is as follows: For more than 18 years I was the technical advisor to Clark County on the Yucca Mountain Program

4. I have reviewed and am familiar with the applicable parts of the Yucca Mountain Repository License Application filed by the Department of Energy ("DOE") with the Nuclear Energy Commission ("NRC") in June, 2008 (the "LA") as they relate to this contention.

5. I have also reviewed and am familiar with the applicable parts of the Final Supplemental 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 (DOE/EIS-0250F-SI) ("SEIS") and the Final 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 (DOE/EIS-0250F) ("FEIS") as they relate to this contention.

6. It is not practicable for the NRC to adopt the DOE environmental impact statement (the FEIS), as it has been supplemented (in the SEIS), based upon the

significant and substantial new information and new considerations set forth below which render the FEIS and the SEIS (together, the "NEPA Analyses") inadequate.

7. The NEPA Analyses potentially substantially underestimates the number of shipments of truck casks of SNF and HLW which are likely to take place on highways within the Nevada Counties of Churchill, Esmeralda, Lander and Mineral Counties (the "Four Counties"), and fails to adequately quantify, analyze and consider the traffic volumes in the Four Counties, all as set forth below.

(a) The DOE in its SEIS assumes and states that the number of shipments of truck casks of SNF and HLW to the repository will be "approximately" 2700 (**SEIS Sections 2.1.7.2, page 2-45, and 6.1.7, page 6-8**). These assumptions are not bounding, as described in the following analysis:

(i) The DOE assumption of the number of truck shipments is based on yet to be concluded legal agreements with the utilities and the construction of a rail line to Yucca Mountain. It is arbitrary to premature make conclusions on contracts that may or may not be concluded, rail lines that may or may not be constructed in a timely manner, and may or may not ever be constructed. It is equally valid to assume that the agreements will not be finalized in a timely manner and/or that the rail line and/or the TAD's will not be available at the time currently assumed by the DOE. In anticipation of that case, an analysis of the impacts of increased truck shipments should have been made. Given that the preferred action is the disposal of 292,000 fuel assemblies (167,000 BWR and 125,000 PWR) and currently available truck casks have a capacity of 4 PWR or 9 BWR assemblies, the total number of truck shipments for commercial SNF could come close to 49,000. (LA Section 1.2.1, Page 1-15). the total number of truck shipments for DOE SNF could be as high as 3,470 (FEIS

Table J-1, Page J-11) and the total number of truck shipments for HLW could be as high as 8,315. (FEIS Table J-1, Page J-11). Hence, the total number of truck shipments could be approximately 61,000. While this is admittedly a worst case scenario, DOE should analyze the effects of shipping more than 10% of the SNF and HLW by truck to the Yucca Mountain repository.

(b) The failure to estimate the effects the of such truck shipments as described in Paragraph 7(a)(i) above is a fatal flaw in the NEPA Analyses in that a valid estimate of the number of such shipments is vital to the determination of the environmental impacts and environmental effects upon the repository and its related processes, as reflected in the accompanying affidavit of Roger Patton, P.E. – Attachment 3 to this contention.

8. The absence of the data described in 7 above is a fatal flaw in the NEPA Analyses in that a valid estimate of the number of such shipments is vital to the determination of the environmental impacts and environmental effects of the repository and its related components.

DATED this 18th day of December, 2008.

E. v. Tiesenhausen

ENGELBRECHT VON TIESENHAUSEN

State of Nevada)
)ss.
County of Clark)

Subscribed and sworn to before me this 18th day of December, 2008

Sally T. Christensen
Notary Public

SALLY T. CHRISTENSEN
Notary Public State of Nevada
No. 04-87256-1
My appt. exp. Feb. 1, 2012

ATTACHMENT 2

AFFIDAVIT OF REX J. MASSEY

I, Rex J. Massey, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Reno, Nevada.

2. I earned a MBA from the University of Nevada and received a BS from Willamette University in Salem, Oregon.

3. I am a principal in Research and Consulting Services, Inc., and on behalf thereof I have participated in evaluations of potential impacts of the Yucca Mountain since 1991 representing Lander and Churchill Counties in Nevada. My professional employment experience includes more than 20 years of experience in planning and management services to government agencies and private entities focusing on development related projects, planning, public financing, project feasibility and environmental analysis. I have completed a number of impact reports related to the Yucca Mountain project in the areas of transportation, risk and local emergency response.

4. My experience with respect to the Yucca Mountain Project consists of the functioning as the program manager for the Churchill and Lander County Yucca Mountain Oversight Programs for the last 15 years.

5. I have reviewed and am familiar with the contents of the Yucca Mountain Repository License Application filed by the Department of Energy ("DOE") with the Nuclear Energy Commission ("NRC") in June, 2008 (the "LA").

6. I have also reviewed and am familiar with the contents of the Final Supplemental 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 (DOE/EIS-0250F-SI ("SEIS") and the Final 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 (DOE/EIS-0250F) ("FEIS") (collectively referred to herein as "the NEPA Documents").

7. From 2000 to 2004, I served as the Chairman of the Transportation Working Group established by the U.S. Department of Energy National Security Administration (NSA) Nevada Site Office in conjunction with the Nevada Test Site Waste Management program. The program's primary mission is to manage legacy radioactive waste generated by the U.S. Department of Energy and defense industry activities. The program is responsible for the proper acceptance and disposal of low-level and mixed low-level waste in compliance with applicable federal, state and local laws. Other program activities include management of transportation and coordination of rural county emergency response grants.

(a) In a related federal action, a Record of Decision was issued at Washington, DC, December 9, 1996, entitled Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada, DOE/EIS-0243 (the "NTS EIS"). Among other requirements, the NTS EIS mandated that DOE establish stakeholder interactions thus they formed the Transportation Working Group to address regional transportation concerns. DOE utilized the Transportation Working Group to fulfill the transportation requirements identified in the NTS EIS. Among its activities were the following:

- Coordinating, and determining the needs of local emergency-response actions and establishing financial requirements to meet those needs;
- Implementation of a policy whereby low-level radioactive waste, mixed low-level radioactive waste and transuranic waste to and from the Nevada Test Site avoided the Las Vegas Valley.

(b) The efforts of DOE and the Transportation Working Group to effectively require such shipments to avoid the Las Vegas Valley and more specifically Interstate 15 and U.S. Highway 95 through the Las Vegas area are

well documented in the Annual Transportation Report for Radioactive Waste Shipments to and From the Nevada Test Site (FY 2000 to Current) prepared by the U.S. Department of Energy National Nuclear Security Administration Nevada Site Office, Las Vegas Nevada.

(c) The Nevada Test Site Waste Acceptance Criteria DOE/NV-325-Rev. 7, June 2008 specifically directs shippers to avoid Las Vegas. Page 6-6 of the Waste Acceptance Criteria states, "*Generators **shall** ensure that a National Environmental Policy Act (NEPA analysis (Title 10 CFR 1021) of the potential waste transportation impacts is completed prior to waste shipment Transportation of waste to the NTS should conform to a supporting finding or decision based on the impact analysis. NNSA/NSO encourages approved generators and their carriers to review route selections. Transportation of LLW and MW to the NTS **shall** avoid Hoover Dam and Las Vegas. Routes selected are required to minimize radiological risk. Information on accident rates, time in transit, population density, construction activities, and time of day shall be considered when determining radiological risk.*"

8. Contrary to the assumption in the NEPA Documents that truck shipments will take place along U.S. 95 south of Yucca Mountain, it is highly unlikely that the such shipments will occur. Shipments of high-level waste through the Las Vegas Valley to the Yucca Mountain Repository would be totally inconsistent with and contrary to DOE's long-standing policy of precluding the shipment of even low-level waste through the Las Vegas Valley. Avoidance of the Las Vegas Valley by such shipments will inevitably lead to a concentration of overweight truck shipments on U.S. 95 through the Nevada Counties of Churchill, Esmeralda, and Mineral, and across Interstate 80 through Churchill and Lander County (the "Four Counties"), with consequential environmental impacts upon both the emergency response capacity and the impacts of transportation by truck as set forth in the contentions and described by the other accompanying affidavits. Furthermore, these impacts would be exponentially increased based upon the increased

volume of truck traffic as set forth in the Affidavit of Engelbrecht von Tiesenhausen, which is also attached to the contention addressed hereby.

9. It is my opinion that in stating that the number of shipments of truck casks of SNF and HLW to the repository will be "approximately" 2700 (**SEIS Sections 2.1.7.2, page 2-45, and 6.1.7, page 6-8**), the NEPA Documents fail to accurately quantify the number of shipments of truck casks of SNF and HLW which are likely to take place on highways within the Four Counties.

10. The failure to accurately estimate the number of such truck shipments within the Four Counties as described above is a fatal flaw in the NEPA Documents. A valid estimate of the number of such shipments is vital to the determination of the environmental impacts and environmental effects of the repository and its related components

11. It is not practicable for the NRC to adopt the DOE environmental impact statement (the FEIS), as it has been supplemented (in the SEIS), based upon the significant and substantial new information and new considerations set forth above which render the NEPA Documents inadequate.

DATED this 16th day of December, 2008

Rex J. Massey

State of Nevada)
)ss.
County of Washoe)

Subscribed and sworn to before me this 16 day of December, 2008

Notary Public

NOTARY PUBLIC
STATE OF NEVADA
County of Washoe
BRENDAN COOPER
No: 08-7131-2
My Appointment Expires Jan. 23, 2012

ATTACHMENT 3

AFFIDAVIT OF ROGER PATTON, P.E.

I, Roger Patton, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Las Vegas, Nevada.

2. My formal education consists of the following: Cornell University, Bachelor of Science in Civil Engineering, 1976; Cornell University, Master of Engineering (Civil), 1977.

3. A summary of my professional qualifications and experience are as follows: I am a Senior Vice President with the Louis Berger Group, a nationally and internationally recognized consulting firm specializing in providing professional transportation engineering services.

I am licensed by the States of Nevada and Arizona as a Professional Engineer.

I have been employed as a Transportation Engineer with the Louis Berger Group for 30 years. For the last 17 years I have directed and managed the firm's Nevada offices. During this period I have served as principal-in-charge for the planning and design of numerous highway projects in Nevada as a consultant to the Nevada Department of Transportation, Clark County, the Regional Transportation Commission of Southern Nevada and other agencies. These projects have included the Widening of I-15 in Las Vegas, the Widening of US-95 in Las Vegas, the Widening of I-515 in Las Vegas, the Las Vegas Beltway, the Carson City Freeway and Improvements to the I-80/US-395 Spaghetti Bowl Interchange in Reno.

In conjunction with these projects, I have served as Project Manager for the preparation of Environmental Impact Statements for the widening of the US-95 and I-515 Freeways in Las Vegas and for the construction of the Southern Segment of the Las Vegas Beltway.

4. In the course of this engagement and in the establishment of the conclusions reached herein, I have utilized the service of Frank Csiga Jr, P.E., Manager of the Northern Nevada operations of The Louis Berger Group, whose credentials include

having served for 28 years with the Nevada Department of Transportation where he most recently held the position of Chief Road Design Engineer.

5. I am familiar with the provisions of the National Environmental Policy Act.

6. I have reviewed and am familiar with the applicable parts of the Final Supplemental 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 (DOE/EIS-0250F-SI) ("SEIS") and the Final 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 (DOE/EIS-0250F) ("FEIS") as they relate to the contention to which this affidavit applies.

7. It is not practicable for the NRC to adopt the DOE environmental impact statement (the FEIS), as it has been supplemented (in the SEIS), based upon the significant and substantial new information and new considerations set forth below which render the FEIS and the SEIS (together, the "NEPA Analyses") inadequate.

8. The NEPA Analyses fail to recognize, analyze, and consider the environmental impacts and environmental effects of the truck shipments of spent nuclear fuel ("SNF") and high level waste ("HLW") to be shipped to the Yucca Mountain repository upon and within the Nevada Counties of Churchill, Esmeralda, Lander and Mineral (the "Four Counties") as set forth below.

9. **Shipment of SNF and HLW by truck using Nevada Highways:** According to the SEIS "Under the Proposed Action, the Department would transport most spent nuclear fuel and high-level radioactive waste from 72 commercial and 4 DOE sites to the Repository in NRC-certified transportation casks or trains dedicated only to those shipments. However, DOE would transport some shipments to the Repository in transportation casks by truck over the nation's highways."[1] In addition to the shipment of

[1] SEIS, page 2-1

approximately 9,500 rail casks by train in rail corridors[2] through Nevada, the SEIS analyzed the shipment of approximately 2,700 truck casks[3] of SNF and HLW on highways through Nevada to the Repository as a part of the Proposed Action. The SEIS makes it clear that the DOE's Proposed Action will include the transportation of SNF and HLW by truck using Nevada highways.

While 2,700 shipments of SNF and HLW will definitely be transported by truck through Nevada with the Proposed Action, the accompanying affidavit of Engelbrecht Von Tiesenhausen indicates that the actual number of truck shipments through Nevada could potentially increase to the neighborhood of 61,000 truck shipments under a worst-case scenario whereby the construction of proposed rail lines in Nevada are substantially delayed.

10. **Overweight Trucks on Nevada Highways:** According to the SEIS, "Trucks that carried transportation casks probably would be overweight rather than legal weight"[4]. Trucks with gross vehicle weights less than 36,000 kilograms (80,000 pounds) are defined as being of legal weight on the nation's highways and were initially evaluated in the FEIS as a potential transportation mode for SNF and HLW. However, "DOE has since determined that trucks carrying truck casks would be more likely to have gross vehicle weights in the range of 36,000 kilograms to 52,000 kilograms (115,000 pounds)."[5] As proposed and evaluated in the SEIS, the truck shipments of SNF and HLW would be transported to the Repository using overweight trucks on Nevada highways as part of the DOE's Proposed Action.

11. **Representative National Routes:** The SEIS identified and analyzed representative national truck routes from SNF and HLW origination sites throughout the United States to the Repository in Nevada. The representative national truck routes identified and analyzed in Nevada include only I-15, CC-215 (the Las Vegas Beltway)

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[2] Rail Corridors are evaluated in the Nevada Rail Corridor SEIS and the Rail Alignment EIS as well as in the SEIS.
[3] SEIS, page 2-45
[4] SEIS, page 2-45
[5] SEIS, page 2-45

and US-95. The specific truck routes to the Repository in Nevada[6] analyzed in the SEIS are:

(a) South on I-15 from Utah to Las Vegas, west along the Northern Beltway (CC-215) through the Las Vegas Valley and then northwest on US-95 to the Repository; and,

(b) North on I-15 from California to Las Vegas, north along the Western Beltway (CC-215) through the Las Vegas Valley and then northwest on US-95 to the Repository.

While the SEIS identified and analyzed only these two specific truck routes in Nevada, it states that "At this time, before receipt of a construction authorization for the Repository and years before a possible first shipment, DOE has not identified the actual routes it would use to ship spent nuclear fuel and high-level radioactive waste to Yucca Mountain. However, the highway and rail routes that DOE used for analysis in this Repository SEIS are representative of routes that it could use. The highway routes conform to U.S. Department of Transportation regulations (49 CFR 397.101). These regulations, which the Department of Transportation developed for Highway Route-Controlled Quantities of Radioactive Materials, require such shipments to use preferred routes that would reduce the time in transit. A preferred route is an Interstate System highway, bypass, beltway, or an alternative route designated by a state routing agency. Alternative routes can be designated by states and tribes under U.S. Department of Transportation regulations (49 CFR 397.103) that require consideration of the overall risk to the public and prior consultation with local jurisdictions and other States."[7]

This statement makes it clear that under U.S. Department of Transportation regulations, a state routing agency, presumably the Nevada Department of Transportation[8] (NDOT), could designate routes to the Repository through the State of Nevada which are different than the representative routes analyzed in the SEIS. Such alternate routes, which certainly exist, have not been identified or analyzed in the SEIS and include routes through the Four Counties.

[6] SEIS, Figure 2-12, page 2-47
[7] SEIS, page 6-4
[8] FEIS, Appendix J, page J-30

12. **Likely Alternative Routes through the Four Counties:** Two interstate highways cross the State of Nevada. I-80 crosses the northern part of the State from east to west from Utah to Northern California. I-15 crosses the southern part of the State from northeast to southwest from Arizona (and Utah) to Southern California. Any SNF and HLW waste shipped to the Repository by truck would enter Nevada on I-80 or I-15 since the preferred route in neighboring states is likely to be an Interstate System highway. I-15 is located in Clark County and passes through Las Vegas, the largest and most populous City in the State of Nevada. I-80 extends through Churchill County and Lander County as well as six other Northern Nevada counties.

The proposed Yucca Mountain Repository is only accessible from US-95, a national highway which extends north-south through Nevada from Oregon to Southern California and connects to both I-80 and I-15. While the portion of US-95 from Las Vegas northward to the Repository has been identified and analyzed in the SEIS as a representative truck route, there are several other routes within the State of Nevada which lead from I-80 and/or I-15 to the Repository and which the NDOT would have the authority to designate as alternative routes for the transportation of SNF and HLW.

Without limiting the number of alternative routes that could be considered, two alternative routes which would be likely candidates are:

(a) I-80 westbound from Utah to US-95 and then US-95 southbound to the Repository. (This route passes through Lander, Churchill, Mineral and Esmeralda Counties); and,

(b) I-80 eastbound from California to Fernley, Nevada, Alt. US-50 eastbound to US-50, US-50 eastbound to Fallon, Nevada, and then US-95 southbound to the Repository. (This route passes through Churchill, Mineral and Esmeralda Counties.)

These alternative routes, utilizing existing highways in the Four Counties, would avoid the shipment of SNF and HLW by overweight trucks through the Las Vegas Valley. As set forth in the contentions and described by the accompanying affidavit of Rex T. Massey, shipment of SNF and HLW through the Las Vegas Valley to the Repository would be totally inconsistent with and contrary to DOE's long-standing policy of precluding the shipment of even low-level waste through the Las Vegas Valley. In light of this precedent and the obligation which rests with the State of Nevada to

designate alternative routes after due consideration of the overall risk to the public, use of the above routes through the Four Counties to avoid the Las Valley is all but a certainty. However, the SEIS does not assess impacts associated with either of these routes which could be designated as alternative routes by the State of Nevada.

I-80 is a four-lane Interstate highway, designed, constructed and maintained to Interstate standards. Alt. US-50 and US-50 are rural highways between Fernley and Fallon which have been recently widened to four lanes by the NDOT. However, US-95 within Churchill, Mineral and Esmeralda Counties is a two-lane rural highway. The FEIS and SEIS do not consider the sufficiency or reliability of US-95, US-50 or Alt. US-50 to accommodate overweight trucks carrying SNF and HLW.

Since US-95 and other rural highways in Nevada are likely to be designated for the transportation of SNF and HLW for all truck shipments to the Repository, then the impacts of the truck shipments and the affects upon the highways should be considered.

The FEIS contends that because trucks transporting SNF and HLW would use existing highways, "measurable impacts would not occur in environmental resource areas other than health and safety in Nevada."[9] Since likely alternative routes for truck shipments in Nevada were not analyzed, measures to identify and mitigate health and safety impacts on highways in the Four Counties have not been addressed in the SEIS.

13. The analysis which follows represents a summary of the estimated environmental impacts and affects upon certain highways and related facilities which are likely to occur by reason of the transportation of SNF and HLW by overweight trucks through the Four Counties.

Rural highways, especially low volume rural highways, are upgraded and maintained less frequently than interstate highways. Accordingly, the initial condition of the roadway and the reliability of maintenance may be insufficient for the safe transportation of SNF and HLW using overweight trucks.

Overweight trucks shipping SNF and HLW will travel at a slower rate of speed than automobile traffic, especially on long ascending grades. This is generally not a problem on four-lane interstate highways where an additional lane is available for passing. However, on two-lane highways such as US-95, faster traffic tends to queue up

[9] FEIS, page 6-61

behind slower moving vehicles. Normal operating procedure is for faster traffic to pass slower moving vehicles by temporarily occupying the on-coming traffic lane in locations where there is adequate sight distance and a gap in on-coming traffic. Roadway safety depends upon the skill and judgment of individual motorists as well as the frequency of passing opportunities. As traffic volumes continue to increase in the future, passing opportunities will become less available.

Specific impacts which can be anticipated include the following:

(a) Traffic safety will decline as traffic backs up behind overweight trucks on two lane highways;

(b) Traffic safety is also compromised if substandard highway design features are not upgraded to current standards; and,

(c) Overweight trucks accelerate the deterioration of pavement, shortening pavement life.

Failure to address these impacts with appropriate mitigation could lead to substantially increased accident rates, increased radiological affects, increased air pollution and increased costs to state and local jurisdictions.

As set forth in the contentions and described in the accompanying affidavit of Engelbrecht Von Tiesenhausen, the number of shipments of truck casks of SNF and HLF on the highways within the Four Counties may have been substantially underestimated. While a minimum of 2,700 truck shipments of SNF and HLW can be expected to be transported on highways through the Four Counties, the actual number of truck shipments could potentially be as high as 61,000. The above impacts will be greatly compounded by such underestimation.

14. Our analysis which follows represents a summary of the suggested measures required to mitigate the foregoing environmental impacts.

(a) Construct passing lanes at intervals of 5 to 10 miles, in accordance with the guidelines of the Transportation Research Board's Highway Capacity Manual, to allow faster traffic to pass;

(b) Increase shoulder width to a minimum of 8 ft. in accordance with AASHTO[10] guidelines;(c) Provide realignment of the highway in locations with substandard geometrics, in accordance with AASHTO guidelines;

[10] American Association of State Highway and Transportation Officials.

(d) Upgrade roadside design features through the use of guardrail, flattened slopes and improved drainage;

(e) Construct truck climbing lanes on long upgrades;

(f) Improve signage to alert drivers to the locations of climbing and passing lanes as safe passing zones;

(g) Upgrade signage to better designate no-passing zones;

(h) Upgrade intersection controls and sight visibility zones as warranted; and,

(i) In accordance with the State of Nevada Highway Preservation Report,

- Provide corrective maintenance on sections of pavement which have been overlayed within the previous 12 years but show signs of physical deterioration;
- Re-construct pavement which has not been overlayed within 12 years; and,
- Provide a pavement maintenance overlay at a minimum of twelve year intervals.

The above mitigation is necessary with the shipment of 2,700 truck casks through Nevada with the Proposed Action. In the worst-case scenario, as described in the affidavit of Engelbrecht Von Tiesenhausen, whereby the actual number of truck shipments of SNF and HLW on Nevada highways may be underestimated by an order of magnitude, widening of US-95 to four lanes would be necessary to provide appropriate mitigation.

15. The collective costs of mitigation for the forgoing environmental impacts and effects during the life of the project are substantial, and should be borne as a project expense.

16. An overweight, over-dimensional truck traveling on the National highway system requires permits from each state through which it travels. The permit may place restrictions on vehicle operations to protect public safety. In Nevada, for example, an overweight truck permit may restrict shipments to daylight hours. The distance traveled by trucks in Nevada may range up to 675 miles following I-80 and US-95 from the Utah border to the Repository. Assuming that the overweight truck permit restricts travel to daylight hours, one or more night-time layover locations will be needed in Nevada. The night-time layover locations may include amenities for the drivers, a refueling station,

inspection area and site security features. The costs to mitigate for permit requirements such as providing for overnight parking, inspections or other features which may only be identified through the permit application process should be borne as a project expense.

17. Section 9.3.1 National Transportation of the SEIS states: "As indicated in the Yucca Mountain FEIS, Section 180(c) of the NWPA requires DOE to provide technical assistance and funds to states for training local government and American Indian tribal public safety officials through whose jurisdictions DOE could plan to transport spent nuclear fuel or high-level radioactive waste. As a specific management action to mitigate impacts, DOE would provide such training. The training would cover procedures for safe, routine transportation and for emergency response situations."

Since transportation routes through the Four Counties could be designated as alternative truck routes for the shipment of SNF and HLW, the costs for training local government representatives in the Four Counties should also be included as a project expense.

DATED: December 15, 2008

Roger Patton, P.E.

State of Nevada)
)ss.
County of Clark)

Subscribed and sworn to before me this 18th day of December, 2008

Notary Public

Notary Public - State of Nevada
County of Clark
CHERYL O. UPCRAFT
My Appointment Expires
January 4, 2011
No: 99-50895-1

U.S. Department of Energy
Office of Civilian Radioactive Waste Management

www.ocrwm.doe.gov

Office of Logistics Management Transportation Program Review

Presented to:
Nuclear Waste Technical Review Board (NWTRB)
Board Fall Meeting

Presented by:
Gary Lanthrum
Director, Office of Logistics Management

September 24, 2008
Las Vegas, Nevada

ATTACHMENT 4

Transportation System Capability

- The utility/transportation interface is constantly evolving
- The last comprehensive survey of utility interfaces was made 12 years ago and is of minimal planning value due to the evolving utility interfaces driven by the deployment of dry storage systems
- The Office of Civilian Radioactive Waste Management (OCRWM) collects data on utility capabilities on Facility Interface Data Sheets (FIDS)
- OCRWM will work with utilities to update data on their site capabilities. This effort is planned to begin about five years in advance of the first shipment
- Updates are also planned, in this same timeframe, for assessments of the near site transportation infrastructure

Infrastructure Support

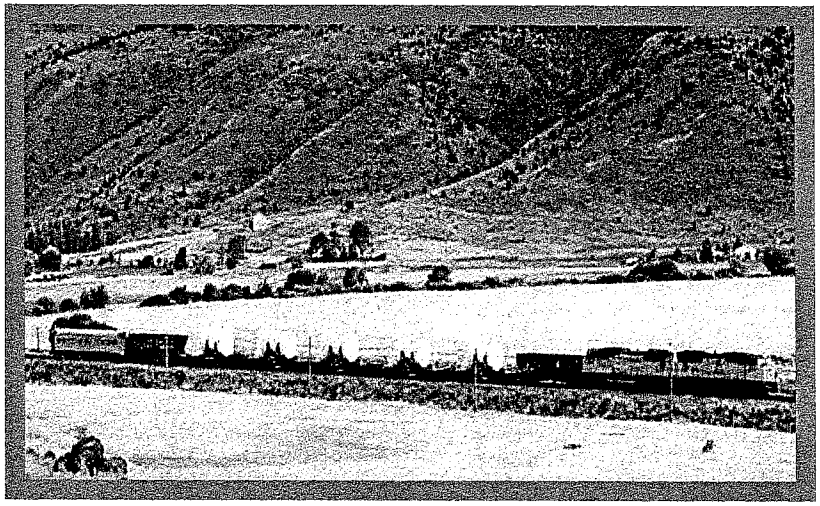
- The Department of Energy (DOE) has no plans to provid funding for any upgrades to generator site or national transportation infrastructure to support shipments
- Under the Proposed Action, the Nevada Rail Line (NRL) would transport 9,495 rail casks in 2,833 spent nuclear fuel trains to the repository. The transportation infrastructure is designed around Transportation, Aging and Disposal (TAD) canisters, but is insensitive to the type of rail cask used
- In the 2008 Yucca Mountain Supplemental Environmenta Impact Statement (SEIS), DOE analyzed the intermodal transfer of rail casks for generator sites that do not have direct rail access
- Studies of national infrastructure (available to improve transportation efficiency) will be conducted approximately five years before shipments begin

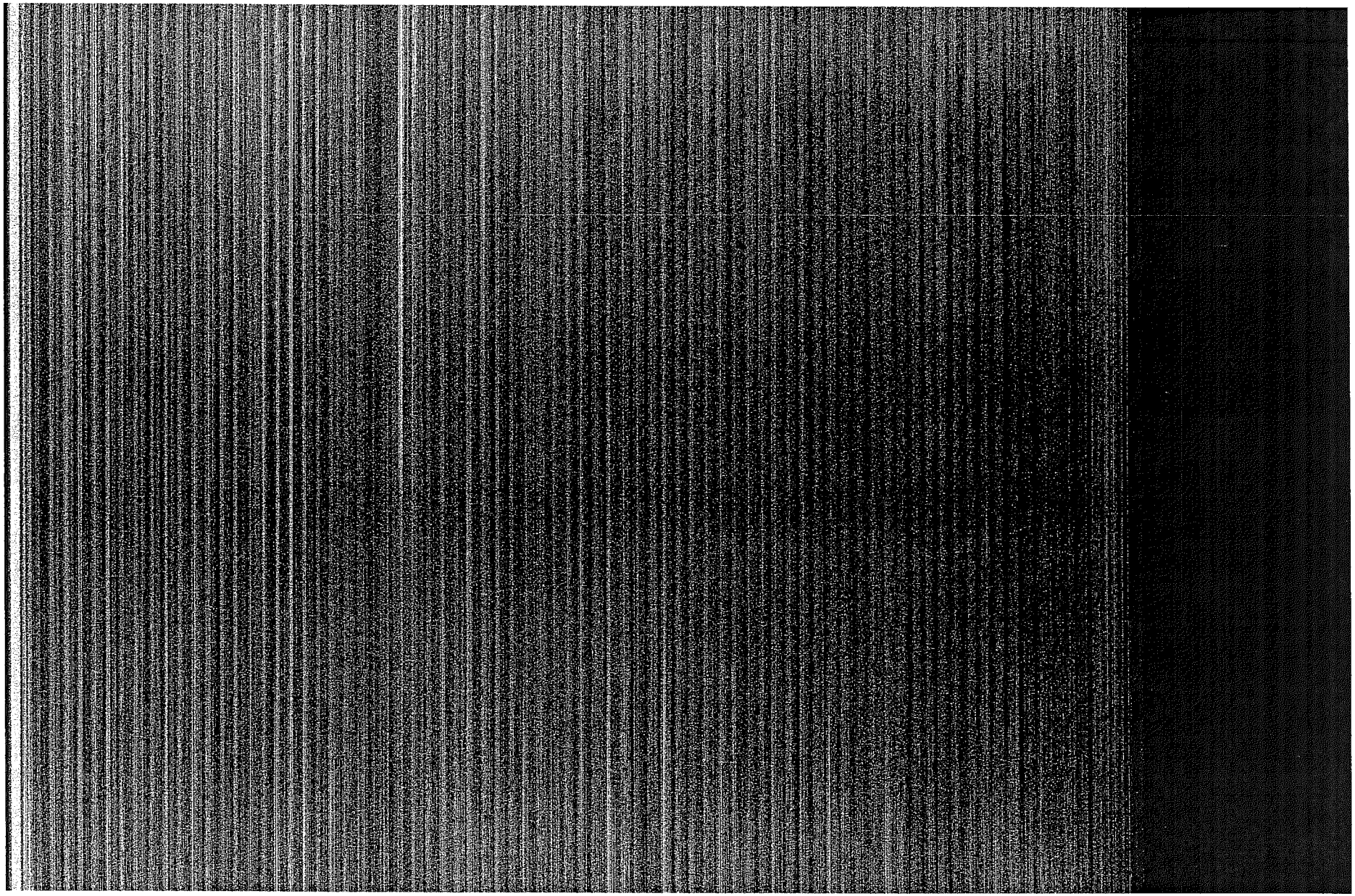
Nevada Rail Line (NRL) Development

- DOE selected the preferred alternative of Mostly Rail as the mode of transport, both nationally and in Nevada
- There are no design and construction challenges with development of the NRL along the analyzed corridors and alignments within the 2008 Final Nevada Rail Corridor SEIS and Rail Alignment EIS
- DOE expanded the discussion of processes for impact mitigation in the Final Rail Alignment EIS. If an alignment is selected, those processes would begin in earnest

Summary

- The utility/transportation interface continues to evolve as the transportations system develops. Processes are in place to adapt the transportation planning to the infrastructure in place when shipments start
- The NRL remains a priority for development of the repository system
- The rail industry is well prepared to design, construct and operate the new rail line in the state of Nevada





ATTACHMENT 5

March 20, 2008

Martin G. Malsch, Esq.
Egan, Fitzpatrick & Malsch, PLLC
2100 K St. NW, Suite 400
Washington, D.C. 20006

SUBJECT: REQUEST BY NEVADA FOR RECONSIDERATION AND CLARIFICATION OF NOTICE OF DENIAL

Dear Mr. Malsch:

This letter responds to your letter dated February 13, 2008. Your letter requested reconsideration and clarification of several aspects of the denial of PRM-51-9, published in the Federal Register on January 31, 2008. 73 Fed. Reg. 5762 (Jan. 31, 2008). PRM-51-9 requested that the NRC modify its regulatory criteria for adopting a final environmental impact statement (FEIS) prepared by the Secretary of the Department of Energy (DOE) in proceedings for issuing a construction authorization and materials license for a geologic repository.

You make two specific requests in your letter. First, on page two, you request that the Commission confirm three assumptions, which are explained on the same page. Second, page three of your letter asks the Commission to explain its decision, and to provide some indication of how the NRC staff will make a decision to adopt the DOE's EIS without performing any independent review of the draft EIS. These requests are addressed below.

Confirmation of Assumptions

First, Nevada requests that the Commission confirm: (1) the assumption that "claims attacking the validity of the Yucca EIS would automatically satisfy the second prong of the test in § 51.109(c) . . . that is, that claims attacking the validity of the Yucca EIS would be cognizable in the Yucca Mountain licensing hearing not only because they constitute 'new considerations' in light of NEI v. EPA, but also because the 'new considerations,' if true, would render the EIS inadequate"; (2) the assumption "that the scope of possible substantive NEPA issues in the licensing hearing will not be limited merely by the fact that, under the NWPA, it will be the adoption decision that is contested rather than the adequacy of the Yucca EIS *per se*"; and (3) the assumption that "[t]he Commission must . . . believe that any substantive NEPA claim is a new consideration meeting the non adoption criterion in 10 C.F.R. § 51.109(c)(2), regardless of whether it is based on new information or new considerations arising before or after DOE's site recommendation." These assumptions are addressed individually below.

Assumption 1

Your first assumption is not entirely clear as written. The NRC would treat as cognizable in the Yucca Mountain proceeding an attack on the Yucca Mountain EIS based on significant and substantial considerations which, if true, would render the EIS inadequate. If that is your

assumption, you are correct. The Commission did not automatically assume at the outset that all claims challenging the validity of the FEIS would contain "significant and substantial" information that, if true, would render the FEIS "inadequate." That issue is left to be resolved in the Yucca Mountain licensing proceeding and will be decided in the context of specific contentions filed in that proceeding.

Assumption 2

You also request confirmation that the scope of substantive issues that may be raised in the Yucca Mountain licensing proceeding will not be limited because NRC's adoption decision – as opposed to the adequacy of the FEIS standing alone – will be at issue. Given the *NEI* decision and the Commission's statement that substantive claims challenging the FEIS will be considered "new considerations" in the context of § 51.109(c), the scope of the possible substantive challenges to the FEIS would not be limited to claims that would come as challenges to the NRC's decision to adopt the FEIS. But the fact that the NRC would be adopting DOE's FEIS pursuant to the direction provided in the Nuclear Waste Policy Act (NWPA) would continue to affect whether a specific challenge to the NRC's adoption decision is suitable for litigation in the Yucca Mountain licensing proceeding. In this regard, the higher threshold for evidence needed to support contentions in § 51.109(a)(2), remains in effect. Thus, Nevada's ability to develop contentions that meet the requirements of § 51.109, which reflects the unique nature of NRC's adoption decision under the NWPA, will continue to determine whether any specific contention is admissible.

Assumption 3

Finally, you ask for confirmation that a substantive NEPA claim is a new consideration meeting the criterion in 10 CFR 51.109(c)(2), whether it is based on new information or new considerations arising before or after DOE's site recommendation. This assumption is correct. Of course, as explained above, the Commission makes no assumptions or predictions about whether any specific substantive claim challenging the validity of the FEIS would, in fact, contain "significant and substantial" information that, if true, would render the FEIS "inadequate" or that such a claim will be supported for admission as required by 10 CFR 51.109(a)(2).

NRC Staff's Decision to Adopt DOE's FEIS

The second specific request in your letter asks the Commission to explain how the NRC staff "will make its adoption decision . . . without any independent review of the draft Yucca EIS." Your request seems to be based on the assertion on page two of your letter that, in denying PRM-51-9, "the Commission also decided that *NEI v. EPA* offered no reason for the Commission to reconsider its position that its Staff need not review the Yucca EIS independently before deciding whether to adopt it, as Nevada requested in its petition." But PRM-51-9 did not directly raise, and the denial did not directly address, the issue of how the NRC staff's adoption review would be conducted. The denial did not state that NRC staff would make its adoption decision "without any independent review" of the FEIS.

The NRC staff will review the FEIS to the extent necessary to support its adoption decision. But the NRC staff's review will not duplicate the environmental review already performed by the DOE. As the *NEI* court recognized, the adoption requirement contained in the NWPA was intended to avoid duplication of the environmental review process. *NEI*, 373 F.3d 1314. In

addition, as acknowledged on page three of your letter, the NRC staff has already reviewed and commented on the draft EIS. The staff's adoption review of the FEIS will be informed by its prior review of the draft EIS.

Sincerely,

Bradley W. Jones/***RA***/
Assistant General Counsel
for Rulemaking & Fuel Cycle

addition, as acknowledged on page three of your letter, the NRC staff has already reviewed and commented on the draft EIS. The staff's adoption review of the FEIS will be informed by its prior review of the draft EIS.

Sincerely,

Bradley W. Jones/***RA***/
Assistant General Counsel
for Rulemaking & Fuel Cycle

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DATE	3/20/2008		3/20/2008		3/20/2008	

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prior to the meeting to be advised of any potential changes in the agenda.

Dated: October 15, 2008.

Cayetano Santos,

Branch Chief, ACRS.

[FR Doc. E8–25147 Filed 10–21–08; 8:45 am]

BILLING CODE 7590–01–P

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Reactor Safeguards (ACRS) Meeting of the Subcommittee on Plant License Renewal; Notice of Meeting

The ACRS Subcommittee on Plant License Renewal will hold a meeting on November 5, 2008, Room T–2B3, 11545 Rockville Pike, Rockville, Maryland.

The entire meeting will be open to public attendance.

The agenda for the subject meeting shall be as follows:

Wednesday, November 5, 2008—1:30 p.m. until 5 p.m.

The Subcommittee will discuss the Vogtle Electric Generating Plant (VEGP), Unit 1 and 2 license renewal application and the associated Safety Evaluation Report (SER). The Subcommittee will hear presentations by and hold discussions with representatives of the NRC staff, VEGP, Southern Nuclear Company, and other interested persons regarding this matter. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the Full Committee.

Members of the public desiring to provide oral statements and/or written comments should notify the Designated Federal Official, Mr. Christopher Brown (telephone 301–415–7111) five days prior to the meeting, if possible, so that appropriate arrangements can be made. Electronic recordings will be permitted. Detailed procedures for the conduct of and participation in ACRS meetings were published in the **Federal Register** on October 6, 2008 (73 FR 58268–58269).

Further information regarding this meeting can be obtained by contacting the Designated Federal Official between 6:45 a.m. and 3:30 p.m. (ET). Persons planning to attend this meeting are urged to contact the above named individual at least two working days prior to the meeting to be advised of any potential changes to the agenda.

Dated: October 16, 2008.

Cayetano Santos,

Branch Chief, ACRS.

[FR Doc. E8–25149 Filed 10–21–08; 8:45 am]

BILLING CODE 7590–01–P

NUCLEAR REGULATORY COMMISSION

[Docket No. 63–001; CLI–08–25]

In the Matter of U.S. Department of Energy (High Level Waste Repository); Notice of Hearing and Opportunity To Petition for Leave To Intervene on an Application for Authority To Construct a Geologic Repository at a Geologic Repository Operations Area at Yucca Mountain

COMMISSIONERS: Dale E. Klein, Chairman; Gregory B. Jaczko, Peter B. Lyons, Kristine L. Svinicki.

I. Notice of Hearing

By letter dated June 3, 2008, the Department of Energy (DOE) submitted an application seeking authorization to construct a geologic repository at a geologic repository operations area at Yucca Mountain in Nye County, Nevada. The NRC published a notice of receipt and availability of this application in the **Federal Register** (73 FR 34348, corrected in 73 FR 40883 (June 17, 2008)). Notice is hereby given that a hearing on the application will be held at a time and place to be set in the future by the Nuclear Regulatory Commission (the Commission) or an Atomic Safety and Licensing Board (Board).

The hearing will consider the application for construction authorization filed by DOE pursuant to Section 114 of the Nuclear Waste Policy Act of 1982 (NWPA), 42 U.S.C. 10134, and pursuant to 10 CFR Parts 2 and 63. The NRC Staff accepted the DOE application for docketing on September 8, 2008 (73 FR 53284 (September 15, 2008)), and the docket number established for this application is 63–001.

The NRC Staff determined that it is practicable to adopt, with further supplementation, the Environmental Impact Statement (EIS) and supplements prepared by DOE. The Staff concluded that neither the 2002 Final Environmental Impact Statement (FEIS) nor the 2008 Final Supplemental Environmental Impact Statement (Repository Supplemental EIS) adequately address all the impacts on groundwater, or from surface discharges of groundwater, from the proposed action. The Staff therefore found that additional supplementation is needed to ensure that the 2002 FEIS and 2008 Repository Supplemental EIS are adequate. The basis for the Staff's position is presented in the "U.S. Nuclear Regulatory Commission Staff's Adoption Determination Report for the U.S. Department of Energy's Environmental Impact Statements for the Proposed Geologic Repository at Yucca Mountain," which is available in the Agencywide Documents Access and Management System (ADAMS) online document system at *http://www.nrc.gov/reading-rm/adams/web-based.html*, at accession number ML082420342.

The NRC Staff will complete a detailed technical review of the DOE application, and will document its findings in a safety evaluation report. If the Commission finds that the DOE application meets the applicable standards of the Atomic Energy Act of 1954, as amended (AEA), the NWPA, and the Commission's regulations, then the Commission will issue a construction authorization, in the form and containing such conditions and limitations, if any, as the Commission finds appropriate and necessary.

II. Opportunity To Petition for Leave To Intervene

A hearing on DOE's construction authorization application will be held in the public interest pursuant to 10 CFR 2.101(e)(8). The hearing will be governed by the rules of procedure in 10 CFR Part 2, Subpart C, "Rules of General Applicability: Hearing Requests, Petitions to Intervene, Availability of Documents, Selection of Specific Hearing Procedures, Presiding Officer Powers, and General Hearing Management for NRC Adjudicatory Hearings"; Subpart J, "Procedures Applicable to Proceedings for the Issuance of Licenses for the Receipt of High-Level Radioactive Waste at a Geologic Repository"; and Subpart G, "Rules for Formal Adjudications." The matters of fact and law to be considered are whether the application satisfies the applicable safety, security, and technical standards of the AEA and NWPA and the NRC's standards in 10 CFR Part 63 for a construction authorization for a high-level waste geologic repository, and also whether the applicable requirements of the National Environmental Policy Act (NEPA) and NRC's NEPA regulations, 10 CFR Part 51, have been met.

Any person whose interest may be affected by this proceeding and who desires to participate as a party must file a written petition for leave to intervene in accordance with the requirements in 10 CFR 2.309, including contentions that satisfy the admissibility standards

in § 2.309. Petitioners seeking to intervene as parties must also comply with the procedural case management requirements set forth in the Advisory Pre-License Application Presiding Officer (PAPO) Board's Memorandum and Order, LBP–08–10 (Case Management Order Concerning Petitions to Intervene, Contentions, Responses, Replies, Standing Arguments, and Referencing or Attaching Supporting Materials), dated June 20, 2008, available at ADAMS accession number ML081720154, and the Advisory PAPO Board's Order (Regarding Contention Formatting and Tables of Contents), dated September 29, 2008, available at ADAMS accession number ML082730764. In addition, as outlined further below, the regulations in 10 CFR Part 2, Subpart J require electronic production, filing and service of all documents in this proceeding.

In ruling on a petition to intervene in this proceeding, the presiding officer shall consider any failure of the petitioner to participate as a potential party in the pre-license application phase under 10 CFR Part 2, Subpart J, in addition to the factors on standing to intervene outlined in 10 CFR 2.309(d).

A petition for leave to intervene must be filed no later than 60 days after the date of publication of this notice in the **Federal Register**. A non-timely petition or contention will not be entertained unless the Commission, an Atomic Safety and Licensing Board, or a presiding officer designated to rule on the petition determines that the late petition or contention meets the late-filed requirements of 10 CFR 2.309(c)(1)(i)–(viii).

Certain hearing schedule milestones in Appendix D to 10 CFR Part 2, as well as the 30-day hearing petition and contention-filing deadlines set forth in 10 CFR 2.309(b)(2) and 51.109(a)(2) are superseded by this notice. A revised hearing schedule with new milestones for actions through the First Prehearing Conference Order appears in Section VI of this notice.

Those permitted to intervene become parties to the proceeding, subject to any limitations in the order granting leave to intervene, and will have the opportunity to participate fully in the conduct of the hearing.

The regulations in 10 CFR Part 2, Subpart J require electronic document production (via the Licensing Support Network) and electronic filing and service of adjudicatory documents via the Electronic Information Exchange (EIE). This requirement applies to all documents filed in the proceeding, including a petition for leave to intervene, and any motion or other document filed in the proceeding prior to the submission of a petition to intervene. Pursuant to 10 CFR 2.1012(b)(1), a petitioner, including a potential party given access to the Licensing Support Network, may not be granted party status under 10 CFR 2.309, or status as an interested governmental participant under 10 CFR 2.315, if the petitioner cannot demonstrate substantial and timely compliance with the requirements in 10 CFR 2.1003 at the time of the request for participation in the high-level waste proceeding.[1] In addition, a petitioner will not be found to be in substantial and timely compliance unless the petitioner complies with all orders of the Pre-License Application Presiding Officer (PAPO) regarding electronic availability of documents. PAPO orders are available on the NRC's high-level waste electronic hearing docket at: *http://hlwehd.nrc.gov/Public_HLW-EHD/home.asp*, under HLW–EHD, folder titled PAPO_HLW, subfolder titled Orders_PAPO.

A petition for leave to intervene, and all filings in the adjudicatory proceeding, must be filed electronically in accordance with 10 CFR 2.1013(c)(1). At least 30 days prior to the filing deadline for a petition to intervene, the petitioner must contact the Office of the Secretary (SECY) by e-mail at: *HEARINGDOCKET@NRC.GOV* or by calling (301) 415–1677, to request (1) a digital ID certificate, which allows the participant (or its counsel or representative) to digitally sign documents and access the E-Submittal server for any proceeding in which it is participating; and/or (2) creation of an electronic docket for the proceeding (even in instances in which the petitioner, or its counsel or representative, already holds an NRC-issued digital certificate). Each petitioner will need to download the Workplace Forms Viewer™ to access the EIE, a component of the E-Filing system. The Workplace Forms Viewer™ is free and is available at *http://www.nrc.gov/site-help/e-submittals/install-viewer.html*. Information about applying for a digital ID certificate is available on the NRC's public Web site at *http://www.nrc.gov/site-help/e-submittals/apply-certificates.html*.

[1] A person denied party or interested governmental participant status under 10 CFR 2.1012(b)(1) may request such status upon a showing of subsequent compliance with the requirements of 10 CFR 2.1003. The subsequent admission of such a party or interested governmental participant shall be conditioned on accepting the status of the proceeding at the time of admission.

Once a petitioner has obtained a digital ID certificate, has had a docket created, and has downloaded the EIE viewer, the petitioner can then submit a petition for leave to intervene. Submissions should be in Portable Document Format (PDF) in accordance with NRC guidance available on the NRC public Web site at *http://www.nrc.gov/site-help/e-submittals.html. Guidance for Electronic Submissions to the NRC* is a consolidated guidance document that sets forth the technical standards for electronic transmission and formatting electronic documents, and provides instructions on how to obtain and use the agency-provided digital ID certificate. A person who holds a current digital ID certificate for use in the proceedings before the PAPO or the Advisory PAPO need not obtain a new certificate. That certificate will remain valid for this proceeding.

Section 2.1013(c) defines service as completed when the filer/sender receives electronic acknowledgement ("delivery receipt") that the electronic submission has been placed in the recipient's electronic mailbox. To be timely, an electronic filing must be submitted to the EIE system no later than 11:59 p.m. Eastern Time on the due date.

Upon receipt of a transmission, the E-Filing system time-stamps the document and sends the submitter an e-mail notice confirming receipt of the document. The EIE system also distributes an e-mail notice that provides access to the document to the NRC Office of General Counsel and any others who have advised the Office of the Secretary that they wish to participate in the proceeding, so that the filer need not serve the documents on those participants separately. Therefore, the applicant and any other participant (or their counsel or representative) must apply for and receive a digital ID certificate before a petition to intervene is filed so that they can obtain access to the document via the E-Filing system.

A person filing electronically may seek assistance through the "Contact Us" link located under the heading "Additional Information" on the NRC Web site at *http://www.nrc.gov/site-help/e-submittals.html* or by calling the NRC technical help line, which is available between 8:30 a.m. and 4:15 p.m., Eastern Time, Monday through Friday. The help line number is (800) 397–4209 or locally (301) 415–4737.

Documents submitted in adjudicatory proceedings will appear in the NRC's high-level waste electronic hearing docket at *http://hlwehd.nrc.gov/Public_HLW–EHD/home.asp* , unless

excluded pursuant to an order of the Commission, an Atomic Safety and Licensing Board, or a presiding officer. Participants are requested not to include personal privacy information, such as social security numbers, home addresses, or home phone numbers in the filing. With respect to copyrighted works, except for limited excerpts that serve the purpose of the adjudicatory filing and would constitute a Fair Use application, participants are requested not to include copyrighted materials in their submission.

Documents may be examined, and/or copied for a fee, at the NRC's Public Document Room (PDR), located at One White Flint North, Public File Area 01 F21, 11555 Rockville Pike (first floor), Rockville, Maryland, and will be accessible electronically through the ADAMS Public Electronic Reading Room link at the NRC Web site *http://www.nrc.gov/reading-rm/adams.html.* The ADAMS accession number for the ADAMS package containing the DOE application is ML081560400. The ADAMS accession number for the ADAMS package containing DOE's Final Environmental Impact Statement is ML032690321, and the accession number for the ADAMS package containing DOE's Final Supplemental Environmental Impact Statement is ML081750191. The ADAMS accession number for the ADAMS package containing DOE's Final Rail Corridor Supplemental EIS and Rail Alignment EIS is ML082460227. The application is also available at *http://www.nrc.gov/waste/hlw-disposal/yucca-lic-app.html.* Persons who do not have access to ADAMS or who encounter problems in accessing documents located in ADAMS should contact the NRC Public Document Room (PDR) Reference staff by telephone at 1–800–397–4209, or 301–415–4737, or by e-mail to *pdr@nrc.gov.*

III. Additional Matters Pertaining to the Hearing and Intervention Requests

A. Standing as of Right

Pursuant to 10 CFR 2.309(d)(2)(iii), the Commission shall permit intervention by the State and local governmental body (county, municipality or other subdivision) in which the geologic repository operations area is located, and by any affected Federally-recognized Indian Tribe, as defined in 10 CFR Part 63, if the contention requirements in 10 CFR 2.309(f) are satisfied with respect to at least one contention. Section 2.309(d)(2) specifies that such State, affected Federally-recognized Indian Tribe, and local governmental body need not address the standing requirements in 10 CFR 2.309(d).

In LBP–08–10, the Advisory PAPO Board requested that the Commission clarify whether an "affected unit of local government" (AULG), as defined in section 2 of the NWPA, as amended (42 U.S.C. 10101), also need not address the standing requirements of section 2.309(d). Any AULG seeking party status shall be considered a party to this proceeding, provided that it files at least one admissible contention in accordance with 10 CFR 2.309. An AULG need not address the standing requirements under that section.

B. Environmental Contentions

In addition to meeting NRC's regular contention admissibility requirements in 10 CFR 2.309(f), environmental contentions addressing any DOE environmental impact statement or supplement must also conform to the requirements and address the applicable factors outlined in 10 CFR 51.109 governing NRC's adoption of DOE's environmental impact statements. The requirements of section 51.109 should be applied consistent with *Nuclear Energy Institute, Inc.* v. *EPA*, 373 F.3d 1251, 1313–14 (D.C. Cir. 2004), a court decision discussing section 51.109, and consistent with the Commission's denial of the State of Nevada's petition to amend section 51.109 (73 FR 5762; January 31, 2008), and the Office of the General Counsel's subsequent letter clarifying the Commission's denial (Letter from Bradley W. Jones, Assistant General Counsel to Martin G. Malsch, dated March 20, 2008, ADAMS accession number ML080810175). Under 10 CFR 51.109(c), the presiding officer should treat as a cognizable "new consideration" an attack on the Yucca Mountain environmental impact statements based on significant and substantial information that, if true, would render the statements inadequate. Under 10 CFR 51.109(a)(2), a presiding officer considering environmental contentions should apply NRC "reopening" procedures and standards in 10 CFR 2.326 "to the extent possible."

C. Hearing Procedures

The construction authorization hearing will be conducted by one or more presiding officers (licensing boards) that will be designated by the Chief Judge of the Atomic Safety and Licensing Board Panel. The Commission anticipates and authorizes the establishment of multiple licensing boards throughout the proceeding. Notice as to the membership of the board(s) will be published at a later date.

In 1991, the Commission suggested that it would use the notice of hearing for a high-level waste (HLW) proceeding to announce detailed case management procedures (56 FR 7787, 7793–94 (February 26, 1991)). In the intervening years, however, the Atomic Safety and Licensing Board Panel has engaged in extensive case management planning for this proceeding. The Commission therefore believes that the presiding officer(s) in this proceeding will be in the best position to establish and efficiently resolve case management issues, some of which the Commission-authorized Advisory PAPO Board resolved in LBP–08–10.

D. Scope of the Hearing

In accordance with 10 CFR 2.1027, in any initial decision on the application for construction authorization, the presiding officer shall make findings of fact and conclusions of law on, and otherwise give consideration to, only material issues put into controversy by the parties and determined to be litigable in the proceeding. The Commission has determined that the scope of the adjudicatory proceeding on safety, security, or technical issues is limited to litigable contested issues. *See* State of Nevada; Denial of Petition for Rulemaking, Docket No. PRM–2–14, available at ADAMS accession number ML082900618. The presiding officer has no authority or duty to resolve uncontested issues in those areas. See 10 CFR 2.1023(c)(2) and 10 CFR 2.1027.

Notwithstanding the provisions in 2.1023(c)(2) and 10 CFR 2.1027, the presiding officer shall make the environmental findings required by 10 CFR 51.109(e), even on uncontested issues, "to the extent it is not practicable to adopt the environmental impact statement prepared by the Secretary of Energy."

E. Participation by a Non-Party

A person who is not a party may be permitted to make a limited appearance statement by making an oral or written statement of his or her position on the issues at any session of the hearing or any pre-hearing conference within the limits and conditions fixed by the presiding officer, but may not otherwise participate in the proceeding.

IV. Access to Non-public information

Those petitioners who seek access to non-public information must follow the access requirements contained in the PAPO Board's Third Case Management Order (August 30, 2007), available at ADAMS accession number

ML072420327. This and other case management orders issued by the PAPO Board govern protection of various categories of protected and privileged information. The Board's case management orders are available on the high-level waste electronic hearing docket, Docket No. PAPO–00, at *http://hlwehd.nrc.gov/Public_HLW-EHD/home.asp* , under HLW–EHD, folder titled PAPO_HLW, subfolder titled Orders_PAPO.

V. Motions

To avoid unnecessary disputes and filings, a party who files a motion must certify, pursuant to 10 CFR 2.323, that he or she has made a reasonable effort to consult with counsel for the applicant and counsel for the NRC staff, as well as other interested counsel or litigants, in an effort to resolve the matter in advance of filing the motion. Motions must also meet all other section 2.323 requirements.

VI. Revised Hearing Schedule Milestones

In CLI–08–18 (August 13, 2008), available at ADAMS accession number ML082261241, the Commission granted the State of Nevada, as well as any other petitioner, an additional thirty (30) days in which to file a petition to intervene, or a petition for status as an interested government participant, in this proceeding. In addition, the Commission proposed further modifications to the schedule codified in 10 CFR Part 2, Appendix D.

The Commission invited any party or potential party participating in the matters before the PAPO Board to provide comments on certain additional proposed extensions of time. The Commission also sought the views of the Atomic Safety and Licensing Board Panel on the reasonableness of current and proposed time frames. The Commission has considered the comments received, and has determined that the revised schedule below will replace certain hearing milestones set forth in Appendix D to 10 CFR Part 2.

The Commission hereby doubles the time permitted to file answers and replies, pursuant to 10 CFR 2.309(h)(1) and (2), respectively, to fifty (50) and fourteen (14) days, respectively. The Commission also extends the period for the First Prehearing Conference from eight (8) to sixteen (16) days after the deadline for filing replies, and extends the period for issuance of the First Prehearing Conference Order from thirty (30) to sixty (60) days after the First Prehearing Conference. The revised Appendix D schedule, reflected in the table below, replaces only the milestones up to, and including, the First Prehearing Conference Order. The presiding officer retains authority to grant extensions of time of no more than fifteen days, and the Commission retains authority to grant extensions of longer than fifteen days, but in either case the litigant seeking the extension must follow the requirements of 10 CFR 2.1026.

PARTIALLY REVISED APPENDIX D SCHEDULE

Day	Action
0	Federal Register Notice of Hearing.
60	Petition to intervene/request for hearing, w/contentions.
110	Answers to intervention and interested government participant Petitions.
124	Petitioner's response to answers.
140	First Prehearing Conference.
200	First Prehearing Conference Order identifying participants in proceeding, admitted contentions, and setting discovery and other schedules.

The regulatory requirements governing the balance of the Appendix D schedule remain unchanged.

VII. September 9, 2008, Petition

On September 9, 2008, the State of Nevada submitted to the Commission a "petition" directed to the content of this hearing notice.[2] In this petition, Nevada argues that the Commission cannot issue a notice of hearing unless it first resolves "at least three important legal and procedural issues."[3]

Nevada's first issue, now partially mooted, is the lack of final Environmental Protection Agency (EPA) standards and implementing NRC rules for the post-10,000 year period. The EPA has now established post-10,000 year standards, and the Staff is developing implementing regulations.[4] Nevada argued that potential parties cannot draft contentions based upon standards that have not been finalized. As a possible remedy, Nevada proposed that today's notice of hearing include a delay—essentially a bifurcation of contention-filing deadlines—with respect to all issues related to the EPA standards and the NRC's implementing rules until some date to be determined after the standards and rules are issued. Nevada argued alternatively that this delay could be avoided if the Commission declined to be bound by its Staff's decision to docket the application.

The Commission recognizes Nevada's concern but does not believe Nevada's extraordinary remedies are necessary, especially since the EPA has now issued the relevant standards, and the NRC's regulations are in preparation. Under the NRC's ordinary practice, Nevada and other hearing petitioners are free to file contentions arguing that the Commission may not authorize construction in the absence of implementing NRC rules. And they are also free to file contentions maintaining that DOE's application does not meet EPA's standards. Such contentions would require no change in the contention-filing schedule set out in CLI–08–18. Nevada or other hearing petitioners may amend their "EPA standards"-related contentions later, after the NRC's implementing rules are issued, if the new NRC rules establish fresh grounds for contentions. Under the unusual circumstances of this case, where controlling agency rules have been delayed, and to ensure that no one is prejudiced, any contentions so amended—on EPA standards-related issues only—will be deemed timely for admissibility purposes if filed within sixty days after the **Federal Register** publication of the NRC rules implementing the new EPA standards.[5]

The second issue Nevada raises in its September 9 Petition concerns a petition for rulemaking it filed regarding the specification of issues for the mandatory hearing portion of this proceeding.[6]

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[2] *Petition to Publish a Fair and Reasonable Notice of Hearing on DOE's Yucca Mountain Application* (Sept. 9, 2008), available at ADAMS accession number ML082550289 (September 9 Petition). The procedural identity of Nevada's "petition" is not obvious. The Commission addresses the issues Nevada raises as part of this notice of hearing solely as a matter of expedience since they touch on topics the Commission already addresses independently.

Both DOE and the NRC Staff responded to the September 9 Petition. See *U.S. Department of Energy Response to State of Nevada "Petition to Publish a Fair and Reasonable Notice of Hearing on DOE's Yucca Mountain Application"* (Sept. 19, 2008); *NRC Staff's Response to the State of Nevada's Petition to Publish a Fair and Reasonable Notice of Hearing on DOE's Yucca Mountain Application* (Sept. 19, 2008).

[3] September 9 Petition at 3.

[4] Final Rule, Public Health and Environmental Radiation Protection Standards for Yucca Mountain, Nevada 73 FR 61,256 (October 15, 2008).

[5] NRC rules ordinarily call on licensing boards to balance several factors in deciding whether to allow late-filed (or amended) contentions. *See* 10 CFR 2.309(c)(i)–(viii). In the case of the yet-to-issue NRC rules, however, the Commission is dispensing in advance with all "late-filed" factors except the "good cause" factor. It is obvious even now that promptly-filed and well-pled contentions based on new, previously unavailable NRC rules—rules that will govern important aspects of NRC's safety review—must be admitted for hearing. There plainly would be "good cause" for filing such contentions late, and no conceivable justification for rejecting them at the threshold.

[6] Petition by the State of Nevada for Rulemaking to Specify Issues for the Yucca Mountain Mandatory Hearing (June 19, 2007).

That petition has now been ruled on, and the Commission's rulemaking decision is reflected in the discussion of the scope of the hearing addressed in Section III.D, above.[7]

Finally, the third issue Nevada raises in its September 9 Petition concerns the status of security clearances and access to classified information in the Yucca Mountain construction authorization application. Nevada argues that its representatives have not been informed of decisions on their security clearances and on access to classified information, "notwithstanding timely applications," so no contentions based on classified information can be prepared.[8] To remedy this, Nevada again asks for a bifurcation of contention-filing deadlines.

It is the Commission's understanding that, as of the end of July, one of Nevada's security clearance applications was complete and was being processed, another application was incomplete, and two applications had been withdrawn.[9] From this, the Commission concludes that the timeliness of Nevada's security clearance applications is factually ambiguous. Moreover, it is not immediately clear that the perceived problem could not be remedied by the provision of redacted versions of classified documents that could provide a basis for the formulation of contentions before the security clearance application reviews are completed. The Commission directs the PAPO Board to resolve both of these questions.

It is so ordered.

Dated at Rockville, Maryland, this 17th day of October, 2008.

For the Commission.

Annette L. Vietti-Cook,

Secretary of the Commission.

[FR Doc. E8–25293 Filed 10–21–08; 8:45 am]

BILLING CODE 7590–01–P

[7] *See* State of Nevada; Denial of Petition for Rulemaking, Docket No. PRM–2–14, available at ADAMS accession number ML082900618.

[8] September 9 Petition at 6.

[9] *See* Letter from Aby Mohseni, Deputy Director, Licensing and Inspection Directorate, Division of High-Level Waste Repository Safety, Office of Nuclear Material Safety and Safeguards to Robert R. Loux, Executive Director, Agency for Nuclear Projects, Office of the Governor, State of Nevada (July 31, 2008), available at ADAMS accession number ML081910097.

NUCLEAR REGULATORY COMMISSION

Advisory Committee on Reactor Safeguards (ACRS); Meeting of the ACRS Subcommittee on Economic Simplified Boiling Water Reactor (ESBWR); Corrected Notice of Meeting (Corrected To Note New Meeting Times)

The ACRS Subcommittee on the ESBWR will hold a meeting on October 21–22, 2008, Room T–2B3, 11545 Rockville Pike, Rockville, Maryland.

The meeting will be open to public attendance, with the exception of a portion that may be closed to protect information that is proprietary to General Electric-Hitachi (GEH) Nuclear Energy and its contractors pursuant to 5 U.S.C. 552b(c)(4).

The agenda for the subject meeting shall be as follows:

Tuesday, October 21, 2008—1 p.m.–5 p.m

Wednesday, October 22, 2008—8:30 a.m.–12 noon.

The Subcommittee will review Chapter 14 of the Safety Evaluation Report with Open Items associated with the ESBWR Design Certification Application. The Subcommittee will hear presentations by and hold discussions with representatives of the NRC staff, GEH, and other interested persons regarding this matter. The Subcommittee will gather information, analyze relevant issues and facts, and formulate proposed positions and actions, as appropriate, for deliberation by the full Committee.

Members of the public desiring to provide oral statements and/or written comments should notify the Designated Federal Official, Dr. Harold J. Vandermolen, (Telephone: 301–415–6236) five days prior to the meeting, if possible, so that appropriate arrangements can be made. Electronic recordings will be permitted. Detailed procedures for the conduct of and participation in ACRS meetings were published in the **Federal Register** on September 26, 2007 (72 FR 54695).

Further information regarding this meeting can be obtained by contacting the Designated Federal Official between 8:30 a.m. and 5 p.m. (ET). Persons planning to attend this meeting are urged to contact the above named individual at least two working days prior to the meeting to be advised of any potential changes to the agenda.

Dated: October 14, 2008.

Cayetano Santos,

Branch Chief.

[FR Doc. E8–25141 Filed 10–21–08; 8:45 am]

BILLING CODE 7590–01–P

NUCLEAR REGULATORY COMMISSION

[Docket No. 70–7001, 70–7002]

Notice of Renewal of Certificates of Compliance GDP–1 and GDP–2 for the U.S. Enrichment Corporation, Paducah and Portsmouth Gaseous Diffusion Plants, Paducah, KY and Portsmouth, OH

ACTION: Notice and issuance of a Director's Decision renewing the Certificates of Compliance for the United States Enrichment Corporation (USEC) allowing continued operation of the gaseous diffusion plants (GDPs), at Paducah, KY, and Portsmouth, OH.

FOR FURTHER INFORMATION CONTACT: Michael Raddatz, Enrichment and Conversion Branch, Division of Fuel Cycle Safety and Safeguards, Office of Nuclear Material Safety and Safeguards, U.S. Nuclear Regulatory Commission, Washington, DC 20555–0001. Telephone: (301) 492–3108; Fax: (301) 492–3363; or by e-mail: *Michael.Raddatz@nrc.gov.*

SUPPLEMENTARY INFORMATION:

I. Introduction

The U.S. Nuclear Regulatory Commission (NRC) is hereby issuing a director's decision authorizing the renewal of the certificates of compliance for the two GDPs located near Paducah, KY, and Portsmouth, OH, for the USEC, allowing continued operation of these plants. The renewal of these certificates for the GDPs covers a 5-year period. USEC submitted individual renewal requests for both the Paducah and Portsmouth GDPs on April 10, 2008, pursuant to Title 10 of the Code of Federal Regulations (10 CFR), Section 76.31.

Pursuant to 10 CFR 76.53, the NRC consulted with and requested written comments on the renewal application from the U.S. Environmental Protection Agency (EPA) and the Department of Energy (DOE). EPA responded in a letter dated September 15, 2008, (ML082840196) stating that it had thoroughly reviewed the USEC application to ensure that USEC had provided an accurate environmental compliance overview. The EPA found that both the local and regional EPA regulators had adequately inspected the

ATTACHMENT 7

AFFIDAVIT OF MARY NUGENT

I, Mary F. Nugent, President of Nevada Security Solutions, LLC hereby depose and state as follows:

1. Nevada Security Solutions, LLC (NSS) is a duly Nevada registered Limited Liability Company located in Las Vegas in good standing.

2. NSS is an information technology company staffed with personnel experienced in rapidly providing information technology operations and web service network infrastructure.

3. Since February 2007, NSS has done extensive investigation, and due diligence on the present state of Nevada's emergency and critical infrastructure protection capabilities in addition to an evaluation of the existing voice and data communication capabilities among government agencies within the State of Nevada. This due diligence and evaluation centered on the technology requirements analysis and the costs associated with the establishment and operation of a state-wide interoperable communication incident management system allowing voice, data, and video communications between and among all appropriate agencies in the state and federal government.

4. On September 24, 2008, the Nevada State Legislature Audit Subcommittee, released its own report on the present capabilities of Nevada's Department of Emergency Management Division (DEM) to effectively respond to emergency situations. The Subcommittee's findings were:

a. That DEM has not demonstrated adequate oversight of, nor coordination with, other entities in preparation of their emergency operation plans or emergency response plans;

b. That "NRS 414 and the federal Department of Homeland Security call for the Division to coordinate efforts on the State, its political subdivisions, private

organizations, and tribal nations. However, the Division could not locate plans for 53 of 95 state agencies, local jurisdictions, charter schools and school districts, resort hotels, and tribal nations from a random sample of these types of entities. In addition there was little documentation in the files showing the division worked with the other entities to encourage them to prepare or update their plans"(Minutes of the Meeting of the Audit Subcommittee of the Legislative Commission, September 24, 2008; Page 19 of 41).

c. Auditors found the Division did not have a process to track emergency equipment that can quickly identify and provide its location that could help minimize the impact of disaster. (*ibid.* page 21 of 41)

5. In regard to the State of Nevada's Legislative Commissions Audit Subcommittee report and similar findings and public statements of the Nevada Homeland Security Commission members on the state of emergency preparedness for natural or manmade medical incident emergency response to include medical emergency treatment plans and procedures, evacuation policies, hazardous material containment operational plans and investigation and evaluation, the following is an overview of the findings:

a. There is presently minimal voice or data communication interoperability between or among the non-law enforcement emergency first responders and their related facilities within the individual counties of the State of Nevada. Additionally, the interconnectivity for rapid dissemination and collection of information, emergency equipment inventory, medical emergency procedures and plans between and among first responder entities of the seventeen counties of Nevada and, the agencies of, and related facilities of the State of Nevada, or between and among Nevada's entities and the emergency managers and related facilities of the U.S. Government is further hindered by the preponderance of stove-piped legacy systems, coupled with a wide range of various IT formats and types of technology hardware presently deployed.

b. There is a clear and pressing need for a rapidly deployed interoperable communication system and database resource library for state-wide information sharing

that can serve as a primary component of effective protection of the health and welfare of the public in connection with shipments of critical and hazardous material to the proposed Yucca Mountain repository in Nye County, Nevada as they pass through multiple counties throughout the State of Nevada.

c. Further, without this interoperable communication network with its unclassified emergency medical and equipment database resource library, the State of Nevada is not currently ready for commencement of shipping hazardous materials into the State of Nevada.

6. NSS has estimated a multifunctional network and data integration center capable of interoperable communications statewide which can be developed and implemented within nine months of contract award at an estimated cost for the acquisition and implementation of such a system and the monthly service fee necessary for its operation, upgrade, and maintenance that would not exceed $7 Million for establishment, and $2.5 million to $3 million per year to operate.

DATED: December 17, 2008

MARY F. NUGENT

State of Nevada)
)ss.
County of Clark)

Subscribed and sworn to before me this 18 day of December, 2008

Notary Public

NOTARY PUBLIC
STATE OF NEVADA
County of Clark
LAURA FITZGERALD
No: 93-0979-1
My Appointment Expires June 25, 2009

ATTACHMENT 8

AFFIDAVIT OF ALAN F. KALT

I, Alan F. Kalt, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Churchill County County, Nevada.

2. I have been the Churchill County Comptroller for the last 16 years. I coordinate the County's Yucca Mountain Project oversite for Churchill County.

3. I am familiar with the presently available resources and capabilities of all existing agencies situated within the County charged with the protection of the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents.

4. In addition, I have evaluated the additional resources which will be required within the County to protect the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents in connection with shipments of truck casks of spent nuclear fuel and high level waste to the proposed Yucca Mountain repository in Nye County, Nevada.

5. The following figures reflect the current resources described in Paragraph 3 above, and the estimated required additional resources described in Paragraph 4 above:

NUMBER OF PERSONNEL	CURRENT RESOURCES	REQUIRED ADDITIONAL RESOURCES
Sheriff's Department	50 FTE's	2 Deputies
Fire Department	45 Volunteers	4 Full-Time
Emergency Medical Techs	29, 17 Full-Time, 12 Part-Time	2 Full-Time
Other-Planning, Mgt. and Training Coordination	Emergency Mgt. Director	Increased time dedicated to this effort
Training Reimbursement	On-going	200 Days

VEHICLES EQUIPMENT AND FACILITIES	CURRENT EQUIPMENT AND FACILITIES	REQUIRED ADDITIONAL EQUIPMENT AND FACILITIES
Sheriff's Department	See detailed Sheriff's Dept Inventory List	1- 4 Wheel Drive SUV with Trailer equipped with radiation monitor
FIRE DEPARTMENT (3 Fire Stations in community)	See detailed Fire Dept Inventory List	1 - New Custom Chassis Pumper Fire Truck.
Emergency Medical (1 ambulance facility in our community	4-ambulances	1 - New Type I Ambulances equipped with vehicle mounted radiation monitor
RADIATION DETECTION EQUIPMENT	0 – Hand held	30 - Wireless, Multi-channel, compact transportable Multi-Gas Radiation Monitors
HOUSING FACILITY FOR FIREFIGHTERS AND EMT'S (Non-volunteers)	1 facility near Banner Churchill Community Hospital	1 – New Fire Station for full-time firefighters and EMT's including response equipment with full bio hazard/cleaning room for hazardous materials
FIRST RESPONDER ROAD RESCUE VEHICLE	0	1 – New First Responder Road Rescue vehicle with water and foam pumping capabilities

PORTABLE HAZARDOUS MATERIAL DECON UNIT	**0**	**1 – State of the art portable hazardous material decontamination unit**
Other EMT Vehicle	**0**	**1-1 Ton Truck for Mass Causality Trailer**
EMT Decon Trailer and Equipment	**0**	**1-Decon Trailer and Equipment**
Hospital Improvements	**0**	**2 Isolation Tents/Showers**
EMT Communications	**0**	**4-Radios**
EMT Equipment	**0**	**Extraction Equipment and other Misc. Equipment**

6. The estimated annual operating costs, in today's dollars, for the Required Additional Personnel is approximately $1,611,000.

7. The estimated capital costs, in today's dollars, for the Required Additional Vehicles, Equipment and Facilities, and for the annual maintenance, operation and replacement thereof is as follows:

Initial Capital Cost $764,000.00

Annual Maintenance $40,275.00 (estimated at .025%)

Annual Operation $50,000.00 (Annual operation dependant on undetermined emergency deployment)

Annual Replacement $161,100.00 (10% annual depreciation estimate)

8. There is presently no voice or data communication interoperability between or among the emergency responders and their related facilities within the County, or between and among the first responders and their related facilities of the County, the first responders and related facilities of the other counties of Nevada, the first responders and related facilities of agencies the State of Nevada and the first responders and related

facilities of the U.S. Government. Such interoperability is a vital, critical, necessary and required component of effective protection of the health and welfare of the public in connection with shipments of truck casks of SNF and HLW to the proposed Yucca Mountain repository in Nye County, Nevada as they pass through multiple counties throughout the State of Nevada. As set forth in the AFFIDAVIT OF MARY NUGENT which is also submitted in connection with this contention, the estimated cost for the acquisition and implementation of such system for Statewide use, in today's dollars, is $7 Million, and the annual operation and maintenance costs for the system, in today's dollars, is $2.5 to $3 million.

9. The County cannot afford to bear the estimated operational or capital costs of the required additional personnel, vehicles, equipment and facilities described above.

10. There is no recognition or analysis of the matters set forth above and no provision for mitigation of the environmental impacts and effects described above in the Final Supplemental 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 (DOE/EIS-0250F-SI) ("SEIS") or the Final 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 (DOE/EIS-0250F) ("FEIS").

11. It is not practicable for the Nuclear Regulatory Commission to adopt the Department of Energy FEIS or SEIS, based upon the significant and substantial new information and new considerations set forth above, which render the FEIS and the SEIS inadequate.

DATED: December 15, 2008

Alan F. Kalt, Churchill County Comptroller

State of Nevada)
) ss.
County of Churchill County)

Subscribed and sworn to before me this 15th day of December, 2008

Notary Public

PAMELA D. AUSTIN
Notary Public-State of Nevada
APPT. NO. 92-3809-4
My App. Expires August 01, 2012

ATTACHMENT 9

AFFIDAVIT OF KEN ELGAN

I, Ken Elgan, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Esmeralda County, Nevada.

2. I have been employed by the County for 14 years, and hold the position Esmeralda County Sheriff

3. I am familiar with the presently available resources and capabilities of all existing agencies situated within the County charged with the protection of the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents.

4. In addition, I have evaluated the additional resources which will be required within the County to protect the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents in connection with shipments of truck casks of spent nuclear fuel and high level waste to the proposed Yucca Mountain repository in Nye County, Nevada.

5. The following figures reflect the current resources described in Paragraph 3 above, and the estimated required additional resources described in Paragraph 4 above:

NUMBERS OF PERSONNEL	CURRENT RESOURCES	REQUIRED ADDITIONAL RESOURCES
SHERRIF DEPARTMENT	18	3 Deputies
FIRE DEPARTMENT (Volunteers in 4 communities)	33	6 (Non-volunteer hazardous material fire fighters)
EMERGENCY MEDICAL TECHS (Volunteer EMT's in 4 communities)	24	4 (Non-volunteer hazardous material EMT's)

VEHICLES EQUIPMENT AND FACILITIES	CURRENT EQUIPMENT AND FACILITIES	REQUIRED ADDITIONAL EQUIPMENT AND FACILITIES
SHERRIF DEPARTMENT	6 - Automobiles 0 - Off road 4 wheel vehicles	1 – 4 wheel passenger vehicle 2 – 4 wheel quad ATV vehicles
FIRE DEPARTMENT (4 Fire Halls in 4 communities)	11 – Trucks	2 - New Custom Chassis Pumper Fire Trucks fully equipped including one truck with a 100 ft. platform aerial
EMERGENCY MEDICAL (3 Ambulance facilities in 3 communities)	6 - Ambulances	3 - New Type I Ambulances equipped with vehicle mounted radiation monitor
RADIATION DETECTION EQUIPMENT	6 – Hand held	22 - Wireless, Multi-channel, compact transportable Multi-Gas Radiation Monitors
RADIATION PROTECTION SUITS FOR FIRE AND EMT PERSONEL	0	114 - Radiation Protection Suits
HOUSING FACILITY FOR FIREFIGHTERS AND EMT'S (Non-volunteers)	0	1 – New Fire Hall for housing firefighters and EMT's including response equipment with full bio hazard/cleaning room for hazardous materials
FIRST RESPONDER ROAD RESCUE VEHICLE	0	1 – New First Responder Road Rescue vehicle with water and foam pumping capabilities
MOBILE COMMAND CENTER	0	1 – New mobile fully self contained command center
PORTABLE HAZARDOUS MATERIAL DECON UNIT	1 – 10 year old	1 – State of the art portable hazardous material decontamination unit

6. The estimated annual operating costs, in today's dollars, for the Required Additional Personnel is approximately $650,000.00

7. The estimated capital costs, in today's dollars, for the Required Additional Vehicles, Equipment and Facilities, and for the annual maintenance, operation and replacement thereof is as follows:

Initial Capital Cost	$2,983,000.00
Annual Maintenance	$74,575.00 (estimated at .025%)
Annual Operation	$50,000.00 (Annual operation dependant on undetermined emergency deployment)
Annual Replacement	$298,000.00 (10% annual depreciation estimate)

8. There is presently no voice or data communication interoperability between or among the emergency responders and their related facilities within the County, or between and among the first responders and their related facilities of the County, the first responders and related facilities of the other counties of Nevada, the first responders and related facilities of agencies the State of Nevada and the first responders and related facilities of the U.S. Government. Such interoperability is a vital, critical, necessary and required component of effective protection of the health and welfare of the public in connection with shipments of truck casks of SNF and HLW to the proposed Yucca Mountain repository in Nye County, Nevada as they pass through multiple counties throughout the State of Nevada. As set forth in the AFFIDAVIT OF MARY NUGENT which is also submitted in connection with this contention, the estimated cost for the acquisition and implementation of such system for Statewide use, in today's dollars, is $7 Million, and the annual operation and maintenance costs for the system, in today's dollars, is $2.5 to $3 million.

9. The County cannot afford to bear the estimated operational or capital costs of the required additional personnel, vehicles, equipment and facilities described above.

10. There is no recognition or analysis of the matters set forth above and no provision for mitigation of the environmental impacts and effects described above in the Final Supplemental 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 (DOE/EIS-0250F-SI) ("SEIS") or the Final 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 (DOE/EIS-0250F) ("FEIS").

11. It is not practicable for the Nuclear Regulatory Commission to adopt the Department of Energy FEIS or SEIS, based upon the significant and substantial new information and new considerations set forth above, which render the FEIS and the SEIS inadequate.

DATED: December 11, 2008

State of Nevada)
) ss.
County of Esmeralda)

Subscribed and sworn to before me this 11 day of December, 2008

Notary Public

RUTH P. LEE
NOTARY PUBLIC
STATE OF NEVADA
ESMERALDA COUNTY
APPT. No. 00-65181-7
MY APPT. EXPIRES OCT. 26, 2012

ATTACHMENT 10

AFFIDAVIT OF GENE P. ETCHEVERRY

I, Gene P. Etcheverry, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Lander County, Nevada (the "County").

2. I have been employed by the County for 2 ½ years, and hold the position of Lander County Executive Director, Director of Emergency Medical Services, and chief administrator overseeing the operations of the Battle Mountain Fire Department.

3. I am familiar with the presently available resources and capabilities of all existing agencies situated within the County charged with the protection of the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents.

4. In addition, I have evaluated the additional resources which will be required within the County to protect the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents in connection with shipments of truck casks of spent nuclear fuel and high level waste to the proposed Yucca Mountain repository in Nye County, Nevada. The need for additional resources was initially identified in the 2007 and 2000 Lander County Emergency Response Assessment and Impact Analysis of Local Capabilities LND000000068 and LDN000000014. The associated costs of additional resources described in LND000000068 and LND000000014 needs to be adjusted for current costs and volume of shipments.

5. The following figures reflect the current resources described in Paragraph 3 above, and the estimated required additional resources not identified in LND 000000068 and LND000000014 described in Paragraph 4 above:

NUMBERS OF PERSONNEL	CURRENT RESOURCES	REQUIRED ADDITIONAL RESOURCES
Sheriff's Department	27	2 Deputies
Fire Department	42-volunteers	4 (full-time fire fighters)
Emergency Medical Techs	12-volunteers	4 (full-time hazardous material EMT's)
Other-Planning, Mgt. and Training Coordination	1 volunteer emergency mgt. director	As described in LND000000068 and LND000000014 adjusted for current cost and volume of shipments

VEHICLES EQUIPMENT AND FACILITIES	CURRENT EQUIPMENT AND FACILITIES	REQUIRED ADDITIONAL EQUIPMENT AND FACILITIES
Sheriff's Department	24 Vehicles	1 – 4 wheel passenger vehicle.
FIRE DEPARTMENT (3 Fire Stations in 3 communities)	14 – Trucks	1 - New Custom Chassis Pumper Fire Truck.
EMERGENCY MEDICAL (3 Ambulance facilities in 3 communities)	3 - Ambulances	1 - New Type I Ambulances equipped with vehicle mounted radiation monitor
RADIATION DETECTION EQUIPMENT	0 – Hand held	30 - Wireless, Multi-channel, compact transportable Multi-Gas Radiation Monitors
HOUSING FACILITY FOR FIREFIGHTERS AND EMT'S (Non-volunteers)	0	1 – New Fire Station for full-time firefighters and EMT's including response equipment with full bio hazard/cleaning room for hazardous materials
FIRST RESPONDER ROAD RESCUE VEHICLE	0	1 – New First Responder Road Rescue vehicle with water and foam pumping capabilities
PORTABLE HAZARDOUS MATERIAL DECON UNIT	0	1 – State of the art portable hazardous material decontamination unit
Hospital Improvements	0	Deluge Shower and isolation room and Regional ID Badge System.
Communication Equipment		As described in LND000000068 and LND000000014 adjusted for current cost and volume of shipments
Other Emergency Response Equipment		As described in LND000000068 and LND000000014 adjusted for current cost and volume of shipments

6. The estimated annual operating costs, in today's dollars, for the Required Additional Personnel is approximately $870,000 and the planning/management and training requirement costs as described in LND000000068 and LND000000014 adjusted for current cost and volume of shipments.

7. The estimated capital costs, in today's dollars, for the Required Additional Vehicles, Equipment and Facilities, and for the annual maintenance, operation and replacement thereof is as follows:

Initial Capital Cost	$1,875,000.00
Annual Maintenance	$46,875.00 (estimated at .025%)
Annual Operation	$75,000.00 (Annual operation dependant on undetermined emergency deployment)
Annual Replacement	$187,500.00 (10% annual depreciation estimate

and the communication equipment and response equipment costs as described in LND000000068 and LND0000000014 adjusted for current cost and volume of shipments.

8. There is presently no voice or data communication interoperability between or among the emergency responders and their related facilities within the County, or between and among the first responders and their related facilities of the County, the first responders and related facilities of the other counties of Nevada, the first responders and related facilities of agencies the State of Nevada and the first responders and related facilities of the U.S. Government. Such interoperability is a vital, critical, necessary and required component of effective protection of the health and welfare of the public in connection with shipments of truck casks of SNF and HLW to the proposed Yucca Mountain repository in Nye County, Nevada as they pass through multiple counties throughout the State of Nevada. As set forth in the AFFIDAVIT OF MARY NUGENT which is also submitted in connection with this contention, the estimated cost for the

acquisition and implementation of such system for Statewide use, in today's dollars, is $7 Million, and the annual operation and maintenance costs for the system, in today's dollars, is $2.5 to $3 million.

9. The County cannot afford to bear the estimated operational or capital costs of the required additional personnel, vehicles, equipment and facilities described above.

10. There is no recognition or analysis of the matters set forth above and no provision for mitigation of the environmental impacts and effects described above in the Final Supplemental 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 (DOE/EIS-0250F-SI) ("SEIS") or the Final 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 (DOE/EIS-0250F) ("FEIS").

11. It is not practicable for the Nuclear Regulatory Commission to adopt the Department of Energy FEIS or SEIS, based upon the significant and substantial new information and new considerations set forth above, which render the FEIS and the SEIS inadequate.

DATED: December 15, 2008

State of Nevada)
) ss.
County of Lander)

JOY L. SWEENEY
NOTARY PUBLIC
STATE OF NEVADA
APPT. No. 93-1018-10
MY APPT. EXPIRES JAN, 4 2009

Subscribed and sworn to before me this 15th day of December, 2008

Notary Public

ATTACHMENT 11

AFFIDAVIT OF EDWARD SMITH

I, Sheriff Ed Smith, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Mineral County, Nevada.

2. I have been employed by the County for 27 years, and hold the position of Sheriff.

3. I am familiar with the presently available resources and capabilities of all existing agencies situated within the County charged with the protection of the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents.

4. In addition, I have evaluated the additional resources which will be required within the County to protect the health and safety of the public through response to emergencies, accidents and injuries arising from transportation, vehicular traffic and related accidents in connection with shipments of truck casks of spent nuclear fuel and high level waste to the proposed Yucca Mountain repository in Nye County, Nevada.

5. The following figures reflect the current resources described in Paragraph 3 above, and the estimated required additional resources described in Paragraph 4 above:

	CURRENT RESOURCES	REQUIRED ADDITIONALRESOURCES
Numbers of Personnel		
Sheriff/Police	18	24
Dispatchers	5	4
Emergency Medical Techs	-	-
Fire Department	43 (4 PD)	20 VOL., 6 PD
EMS	29	10 VOL., 6 PD
Emergency Management	1	1
Hazardous Materials	43 OPS Level Vol.	6 PD Tech Level
Medical	104	1- Full time DR. with Hazardous/Radiological Material Training 4- Full time registered Nurses with Hazardous/Radiological Material Training 1- Full time Maintenance Person With proper training
Vehicles, Equipment and Facilities		
Sheriff/Police	14 Vehicles 1 Facility 14 Radios 4 Repeaters 14 Handheld	6 Vehicles 1 Centralized Communications/ Dispatch Center 3 Base Radio Consoles 4 Repeaters 6 Handhelds
Emergency Medical Techs	-	-

Fire Department (4 Communities)	6 Type 1 Pumpers	1 Heavy Rescue
	3 Type 6 Apparatus	2 Type 1 Pumpers
		1 Snorkel
		All Fully Equipped
EMS (4 Communities)	4 Fire/EMS Stations	1 Station – Hazmat Response Expand 3 Stations
	5 Ambulances	2 Ambulances
Emergency Management	0 (Share w/ FD)	1 Complete Emergency Operations Center
	0 Vehicles	1 SUV
Hazmat Operations	1 Operations Trailer w/ Equip.	1 Hazmat Response W/Decon capability & equipped
Mobile Command Post	0	1 Mobile command Post
Training	Hazmat OPS Level	Hazmat Tech Level
Medical	1 Portable Hazardous Material Decon Unit	1 Radiological/ Hazardous Material Decon Building with State of the art Equipment. 10 Handheld wireless, radiation alert monitors. 20 Wireless multi-Channel, compact Transportable multi-gas Monitors. 50 Radiation protection suits.

6. The estimated annual operating costs, in today's dollars, for the Required Additional Personnel is approximately $ 1,525,000.00.

7. The estimated capital costs, in today's dollars, for the Required Additional Vehicles, Equipment and Facilities, and for the annual maintenance, operation and replacement thereof is as follows:

Initial Capital Cost	$ 10,341,500.00
Annual Maintenance	$ 258,538.00
Annual Operation	$ 288,000.00
Annual Replacement	$ 1,034,105.00

8. There is presently no voice or data communication interoperability between or among the emergency responders and their related facilities within the County, or between and among the first responders and their related facilities of the County, the first responders and related facilities of the other counties of Nevada, the first responders and related facilities of agencies the State of Nevada and the first responders and related facilities of the U.S. Government. Such interoperability is a vital, critical, necessary and required component of effective protection of the health and welfare of the public in connection with shipments of truck casks of SNF and HLW to the proposed Yucca Mountain repository in Nye County, Nevada as they pass through multiple counties throughout the State of Nevada. As set forth in the AFFIDAVIT OF MARY NUGENT which is also submitted in connection with this contention, the estimated cost for the acquisition and implementation of such system for Statewide use, in today's dollars, is $7 Million, and the annual operation and maintenance costs for the system, in today's dollars, is $2.5 to $3 million.

9. The County cannot afford to bear the estimated operational or capital costs of the required additional personnel, vehicles, equipment and facilities described above.

10. There is no recognition or analysis of the matters set forth above and no provision for mitigation of the environmental impacts and effects described above in the Final Supplemental 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 (DOE/EIS-0250F-SI) ("SEIS") or the Final 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 (DOE/EIS-0250F) ("FEIS").

11. It is not practicable for the Nuclear Regulatory Commission to adopt the Department of Energy FEIS or SEIS, based upon the significant and substantial new information and new considerations set forth above, which render the FEIS and the SEIS inadequate.

DATED: December 15, 2008

State of Nevada)
) ss.
County of Mineral)

Subscribed and sworn to before me this 15th day of December, 2008

Notary Public

LINDA M. LARSON
Notary Public - State of Nevada
Appointment Recorded in Mineral County
No: 90-2230-12 - Expires February 1, 2012

ATTACHMENT 12

U.S. DEPARTMENT OF ENERGY

NATIONAL NUCLEAR SECURITY ADMINISTRATION

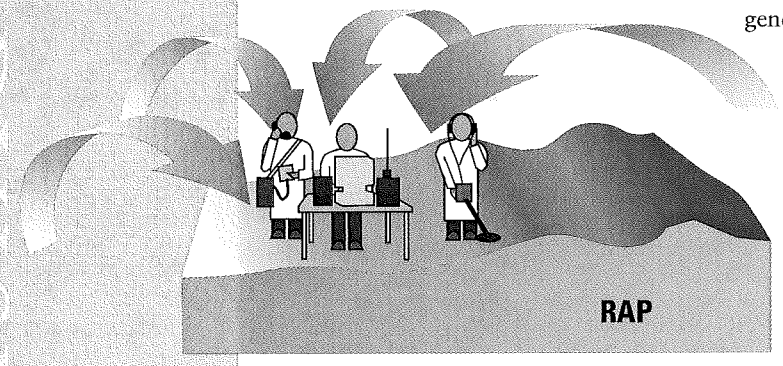
RADIOLOGICAL ASSISTANCE PROGRAM (RAP)

The Department of Energy's (DOE) National Nuclear Security Administration (NNSA) has the world's leading scientists, engineers and technicians from over 50 years of managing the nation's nuclear weapons program. When the need arises, DOE is prepared to respond immediately to any type of radiological accident or incident anywhere in the world with the following seven radiological emergency response assets.

AMS (Aerial Measuring System) detects, measures and tracks radioactive material at an emergency to determine contamination levels. **ARAC** (Atmospheric Release Advisory Capability) develops predictive plots generated by sophisticated computer models. **ARG** (Accident Response Group) is deployed to manage or support the successful resolution of a U.S. nuclear weapons accident anywhere in the world. **FRMAC** (Federal Radiological Monitoring and Assessment Center) coordinates Federal radiological monitoring and assessment activities with those of state and local agencies. **NEST** (Nuclear Emergency Support Team) provides the nation's specialized technical expertise to the Federal response in resolving nuclear/radiological terrorist incidents. **RAP (Radiological Assistance Program)** is usually the first NNSA responder for assessing the emergency situation and deciding what further steps should be taken to minimize the hazards of a radiological emergency. **REAC/TS** (Radiation Emergency Assistance Center/Training Site) provides treatment and medical consultation for injuries resulting from radiation exposure and contamination, as well as serving as a training facility.

INTRODUCTION

The Radiological Assistance Program (RAP), established in the late 1950's, is one of the emergency response resources, or assets, administered by NNSA. RAP is NNSA's first-responding resource in assessing the emergency situation and advising decision-makers on what further steps could be taken to evaluate and minimize the hazards of a radiological emergency. Specific areas of expertise include assessment, area monitoring, and air sampling, exposure and contamination control.



RADIOLOGICAL ASSISTANCE PROGRAM

U.S. DEPARTMENT OF ENERGY

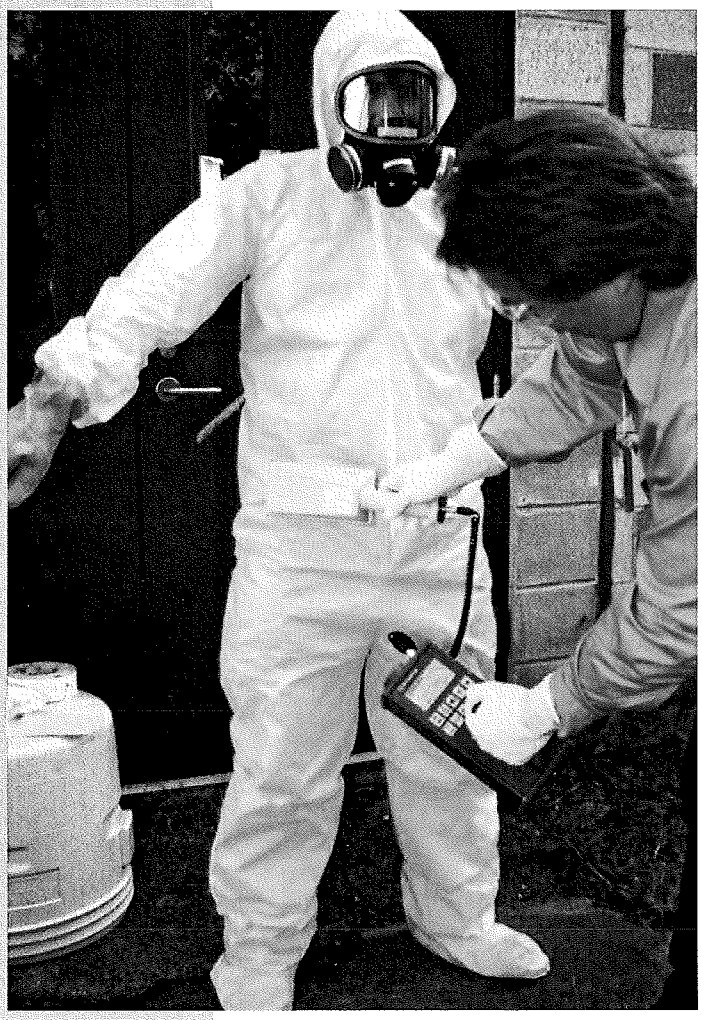
NATIONAL NUCLEAR SECURITY ADMINISTRATION

MISSION

The RAP mission is to provide a flexible, around the clock response capability to Federal agencies, state, Tribal, and local governments, and to private businesses or individuals for incidents involving radiological materials. RAP provides around the clock response capability to radiological emergencies.

CAPABILITIES

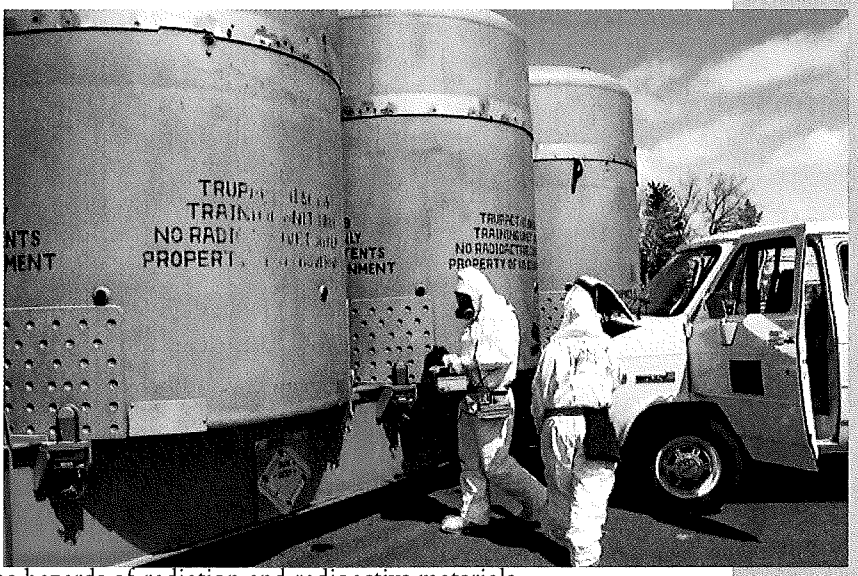
RAP is capable of providing assistance in all types of radiological incidents. Requests for assistance may relate to facility or transportation accidents involving radiation or radioactive material. The accident may involve fire, personal injury, contamination, and real or potential hazards to the public. RAP's support ranges from giving technical information or advice over the telephone to sending highly trained people and state-of-the-art equipment to the accident site to help identify and minimize any radiological hazards.



Survey equipment is used to detect and measure radiation.

RAP is implemented on a regional basis and has eight Regional Coordinating Offices (RCOs) in the U.S. The eight RAP regional offices (Regions 1 through 8, respectively) are: Brookhaven, NY; Oak Ridge, TN; Savannah River, SC; Albuquerque, NM; Chicago, IL; Idaho Falls, ID; Oakland, CA; and Richland, WA. RAP teams from one region can integrate into and assist RAP teams from other regions. Each RCO has a minimum of three RAP teams. A full RAP team consists of seven members: a team leader, a team captain, four health physics support personnel, and a public information officer. RAP teams may deploy with two or more members; one member is the DOE team leader.

STEPS IN THE RAP EMERGENCY RESPONSE



If an emergency occurs, RAP team members normally arrive at the scene within four to six hours after notification and conduct the initial radiological assessment of the area. A RAP response is tailored based on the scale of the event and additional RAP teams and resources can be deployed as necessary. RAP team members are trained in the hazards of radiation and radioactive materials to provide initial assistance to minimize immediate radiation risks to people, property, and the environment. RAP may utilize other NNSA assets, such as AMS, ARAC, or REAC/TS in their response. RAP is able to quickly assess the affected area and advise decision-makers on what actions to take and determine if additional resources are necessary to manage the emergency.

respond
assess
advise

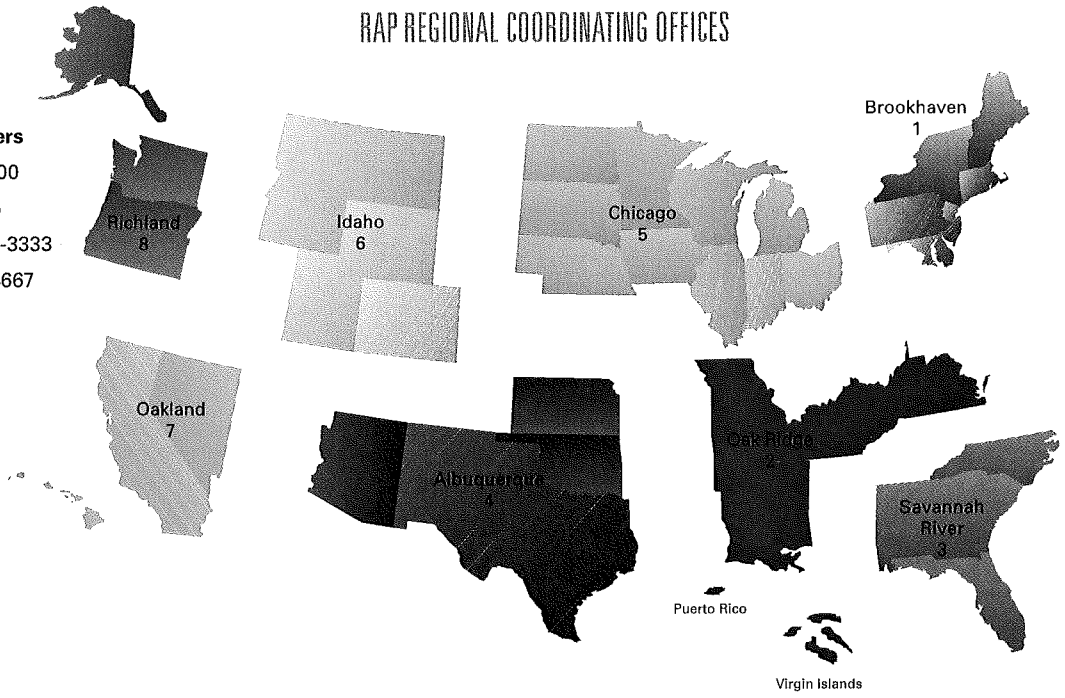
ABOUT THE EQUIPMENT

RAP's highly trained teams have access to the most advanced radiation detection and protection equipment available. The RAP teams' capabilities and resources include portable field radiation monitoring instrumentation (alpha, beta, gamma, and neutron), generators, mobile laboratories, air sampling and decontamination equipment. Communications and personnel protective equipment and supplies are also available to support the response.

U.S. DEPARTMENT OF ENERGY

NATIONAL NUCLEAR SECURITY ADMINISTRATION

RAP REGIONAL COORDINATING OFFICES



Regional Offices — 24 hour numbers

1. Brookhaven, NY — (631) 344-2200
2. Oak Ridge, TN — (865) 576-1005
3. Savannah River, SC — (803) 725-3333
4. Albuquerque, NM — (505) 845-4667
5. Chicago, IL — (630) 252-4800
6. Idaho Falls, ID — (208) 526-1515
7. Oakland, CA — (925) 422-8951
8. Richland, WA — (509) 373-3800

Headquarters — (202) 586-8100

WHEN THE JOB IS DONE

RAP's mission is complete when the need for assistance ends or when there are other resources (state, local, Tribal, or commercial services) able to handle the situation. The primary responsibility for an emergency involving radioactive materials remains with the party responsible for the material. Assistance provided by RAP teams does not preempt state, Tribal, or local authority.

OTHER RAP ACTIVITIES

In addition to providing radiological emergency assistance, RAP can provide emergency response training to state and local first responders, upon request. Since 1996, RAP has been involved in the Weapons of Mass Destruction First Responder Training Program with the objective of preparing the United States for responding to a terrorist attack involving nuclear, biological or chemical weapons of mass destruction. RAP's unique qualifications make it an integral partner in the success of the Domestic Preparedness Program.

For more information, contact:
Office of Emergency Response
U.S. Department of Energy
19901 Germantown Road
Germantown, MD 20874
301-903-3558

ATTACHMENT 13

EPRI | ELECTRIC POWER RESEARCH INSTITUTE

Occupational Risk Consequences of the Department of Energy's Approach to Repository Design, Performance Assessment and Operation in the Yucca Mountain License Application

1018058

Occupational Risk Consequences of the Department of Energy's Approach to Repository Design, Performance Assessment and Operation in the Yucca Mountain License Application

1018058

Technical Update, August 2008

EPRI Project Manager

A. Sowder

ELECTRIC POWER RESEARCH INSTITUTE
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ORGANIZATION(S) THAT PREPARED THIS DOCUMENT

Electric Power ResearcInstitute

Monitor Scientific, LLC

Energy Resources International, Inc.

ABS Consulting, Inc.

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NOTE

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This document describes research sponsored by EPRI.

This publication is a corporate document that should be cited in the literature in the following manner:

Occupational Risk Consequences of the Department of Energy's Approach to Repository Design, Performance Assessment and Operation in the Yucca Mountain License Application. EPRI, Palo Alto, CA: 2008. 1018058.

REPORT SUMMARY

EPRI has discovered several aspects of the U.S Department of Energy (DOE) proposed design and operation of the Yucca Mountain repository that—if implemented as described in the license application (LA)—could result in unnecessary occupational health and safety risk to workers involved with repository-related activities. This report identifies key DOE conservatisms and focuses on the occupational risk consequences of the DOE's approach to the repository design, performance assessment, and operation.

Background

A deep geologic repository at Yucca Mountain, Nevada, has been proposed for the disposal of commercial spent nuclear fuel (CSNF) from nuclear power plants and other nuclear fuel and high level radioactive waste (HLW) from defense and nuclear weapons programs. The DOE has submitted the LA to the U.S. Nuclear Regulatory Commission (NRC) for approval to construct the Yucca Mountain repository. The LA and its supporting documents present information on the area surrounding the Yucca Mountain site and the design of the proposed repository surface and subsurface facilities. The LA also includes the DOE assumptions and calculations intended to demonstrate compliance with applicable regulatory requirements. Many of these assumptions and calculations are extremely conservative and have the potential to result in activities that could expose workers to unnecessary occupational health hazards. These hazards exceed those that would be experienced if the DOE had developed the design and performed its analyses using a more realistic approach, such as that recommended by the National Academy of Sciences in its *Technical Bases for Yucca Mountain Standards* report issued in 1995.

Objectives

To identify aspects of the DOE-proposed approach to Yucca Mountain repository design, performance assessment, and operation that have the potential to expose workers in the nuclear and other related industries to occupational health risks in excess of those that would be encountered if the DOE had taken a more realistic LA approach.

Approach

In developing this report, EPRI reviewed the Yucca Mountain LA and analyzed 1) the assumptions made by DOE in its analyses, 2) how those assumptions affected the proposed design and operation of the repository, and 3) how the resulting approach has the potential to cause occupational health risks to workers involved with activities at the repository, the reactor, and other commercial sites that could otherwise be avoided if a more realistic approach had been taken. The focus of EPRI's analyses was to identify those activities that could lead to unwarranted occupational health risks and that could be eliminated or modified without impacting the performance of the repository or its compliance with applicable regulations.

Results

EPRI recognizes that there are a certain amount of hazards and risks associated with Yucca Mountain repository-related activities and that it is impossible to reduce such hazards and risks to zero. The term "unnecessary," as used in this report, is intended to mean the additional risk that may be incurred by performing an activity in the manner proposed by DOE versus the more limited amount of risk that may be incurred by performing the activity in some alternative manner. The difference between the two levels of risk is considered by EPRI to be "unnecessary."

Unnecessary risks of interest include but are not limited to the 1) proposed use of an undersized transportation, aging and disposal (TAD) canister; 2) exclusion of direct disposal of existing, loaded, dual-purpose canisters (DPCs); 3) underestimation of the fraction of CSNF that will be shipped from reactor sites in a manner that will require processing in a single wet handling facility; 4) overestimation of igneous and seismic hazards, resulting in over-designed facilities and additional complexity for performance assessments and regulatory compliance demonstration; and 5) pileup of conservatisms in assumptions and analyses that have caused DOE to unnecessarily include drip shields in the subsurface design. Any delays in the regulatory process caused by the inclusion of subjects that could otherwise be avoided, or in the shipment of CSNF to the repository, have the potential to impose additional and unnecessary occupational health risks on workers and slowdown in facility completion. Similarly, the performance of any extra manufacturing, transportation, construction, and/or installation activities that could otherwise be avoided carries with it additional health and safety risks for workers. This is especially true for activities involving large and cumbersome components, such as drip shields and transportation casks, or work in difficult environments such as will be encountered at remote sites and in underground locations.

EPRI Perspective

While DOE design and analysis choices, as presented in the Yucca Mountain LA, have led to a demonstration of compliance with the draft Yucca Mountain regulations, EPRI's analysis has shown that some DOE choices have the potential to cause unnecessary occupational health and safety risks. Such risks could be avoided while still demonstrating repository compliance with the applicable regulations. It is EPRI's position that DOE should have used more realistic, as opposed to overly conservative, assumptions in designing and assessing the proposed Yucca Mountain repository system.

Keywords

Yucca Mountain
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INTRODUCTION

On June 3, 2008, the U.S. Department of Energy (DOE) submitted a license application to the U.S. Nuclear Regulatory Commission (NRC) for authorization to construct a deep geologic repository for disposal of High Level Nuclear Waste (HLW) and commercial Spent Nuclear Fuel (CSNF). The Yucca Mountain license application represents a milestone itself as the culmination of close to two decades of study and evaluation. As a candidate licensee for the construction and eventual operation of a deep geologic HLW repository, DOE has made numerous assumptions and estimates that are conservative in nature. For example, in the January 2008 Total System Performance Assessment – License Application Analysis and Model Report (referred to within this report as the TSPA-LA AMR or TSPA-LA) (DOE, 2008a, pg. ES-9], DOE states: "Typically, when two or more models exist for the same phenomena and data, the more conservative one from a total-system perspective has been chosen for implementation."

For nearly 20 years, the Electric Power Research Institute (EPRI) has been reviewing the U.S. Department of Energy's development of the proposed geologic repository for disposal of high-level radioactive waste and spent nuclear fuel at Yucca Mountain, Nevada. Independent analyses and data collection conducted by EPRI suggest that there are many issues with respect to the current DOE design and analyses, as presented in the License Application, that may result in unnecessary occupational health hazards to workers in the nuclear industry and other related industries.

In its Yucca Mountain Review Plan (NRC, 2003), NRC states:

> Consideration of radiological risk in the design and construction of the repository and the limitation of such risk is also consistent with a commitment to the 'As Low as Reasonably Achievable' (ALARA) principles of Regulatory Guide 8.8, as is called for in 10 CFR Part 20 and Section 2.1.1.8 of NUREG 1804, the Yucca Mountain Review Plan (YMRP).

Thus, NRC is stating it will review DOE's Yucca Mountain license application with consideration of ALARA principles. In this report, EPRI has interpreted NRC (2003) to mean ALARA principles should be considered for the *entire* spent fuel waste management process – from storage of commercial spent nuclear fuel (CSNF) at the reactor sites, loading and transfer of CSNF at the reactor sites, transportation of the CSNF to receipt, handling, and disposal of the CSNF at Yucca Mountain. EPRI has considered both radiological and non-radiological occupational health and safety risks during reactor-site storage, CSNF transfer and loading, CSNF transportation, CSNF management at Yucca Mountain, and construction of appropriate CSNF management facilities at the reactor sites and at Yucca Mountain.

The purpose of this report is to identify those issues and provide semi-quantitative estimates of the "unnecessary" occupational health risks that may result from the DOE Yucca Mountain analyses and repository design such that the proposed analyses and designs are not consistent with ALARA principles. While EPRI recognizes there could be additional, "unnecessary" health hazards to the public due to DOE's analysis and design, public health hazards are not assessed quantitatively in this report. Except on a limited basis, neither will this report quantitatively

estimate economic consequences of unnecessary or inappropriate elements of the DOE design or analyses.

For purposes of this report, the term "unnecessary" is intended to mean the additional risk that may be incurred by performing an activity in the manner proposed by DOE versus the more limited amount of risk that may be incurred by performing the activity in some alternative manner that EPRI considers to be more consistent with the principles of ALARA. The difference between the two levels of risk is considered by EPRI to be "unnecessary." EPRI recognizes that there are a certain amount of hazards and risks associated with all such activities and that it is impossible to reduce such hazards and risks to zero.

In this report, the terms "risk", "hazard", "impact", "consequence", among others are used in their most general sense and interchangeably to denote the undesirable outcome or effect that results from an action, assumption, or decision made by DOE in its approach to the design, assessment, and operation of Yucca Mountain. EPRI recognizes that these terms also have more precise technical meanings.

As in other EPRI reports, the intent of this report is not to present worst-case analyses, but rather to adhere to the intent of the EPA's proposed regulatory structure in 40 CFR 197 (EPA, 2005), which is to provide more realistic analyses:

> Overly conservative assumptions made in developing performance scenarios can bias the analyses in the direction of unrealistically extreme situations, which in reality may be highly improbable, and can deflect attention from questions critical to developing an adequate understanding of the expected features, events, and processes ("Assumptions, Conservatisms, and Uncertainties in Yucca Mountain Performance Assessments," Sections 11 and 12, July 2005, Docket No. OAR-2005-0083-0085). The reasonable expectation approach focuses attention on understanding the uncertainties in projecting disposal system performance so that regulatory decision making will be done with a full understanding of the uncertainties involved. Thus, realistic analyses are preferred over conservative and bounding assumptions, to the extent practical. (40 CFR 197: EPA, 2005)

According to 40 CFR 197.14, "reasonable expectation":

- "Requires less than absolute proof because absolute proof is impossible to attain..."
- "Accounts for the inherently greater uncertainties in making long-term projections..."
- "Does not exclude important parameters from assessments and analyses simply because they are difficult to precisely quantify..."
- "Focuses performance assessments and analyses upon the full range of defensible and reasonable parameter distributions rather than only upon extreme physical situations and parameter values"

While some conservatism in the face of uncertainty is warranted, especially given the proposed one million year compliance period for repository performance, repeated application of overly conservative assumptions and estimates in performance assessment will likely result in overly designed facilities in order to provide excess performance margins for the protection of the health of hypothetical future lives at the expense of present day workers and public. Overly conservative and unrealistic assessment of repository performance is not a risk-neutral endeavor. Each additional activity undertaken by DOE and its contractors during construction, operation,

and closure of the repository carries with it finite levels of risk to the workers that must carry out those activities. Moreover, assumptions integral to the DOE proposed approach to the repository also have serious consequences for the utilities that currently manage the spent nuclear fuel onsite in wet and/or dry storage configurations.

DOE's cleanup efforts under its Environmental Management program have been repeatedly criticized for what has been termed "the unacknowledged transfer of risk" (Young and Wood, 2001; Church, 2001) in which conservative assumptions drive costly remedial actions that impose unjustified risks of fatalities and injuries to workers and the public during construction and transportation.

Workers, including those at utility sites, are likely to bear the greatest burden associated with such risk transfer each time DOE chooses overly conservative options in its repository design, analyses, and operational planning.

Workers are likely to bear the greatest burden associated with such unintended and unjustified transfers of risk each time DOE chooses overly conservative options in its repository design, analyses, and operational planning. Unjustified and unnecessary elements of the DOE license application represent an unfair and unjustified transfer of risk from hypothetical future lives to existing nuclear industry and utility workers, as well as present day members of the public.

The purpose of this report is bring attention to elements of the DOE total-system performance assessment and proposed approach to the repository design, construction, and operation, as presented in the 2008 license application and supporting documents, that could result in additional, non-trivial risk burdens for present day workers both in terms of radiological and non-radiological risks, and to provided quantitative estimates of those risks, where possible.

1.1 Issues and Potential Consequences for Occupational Health

The issues and potential unnecessary occupational health hazards are summarized in the following subsections. Each of these issues and their effect on occupational health risks are discussed in more detail in the following chapters.

1.1.1 Some Dual-purpose Canisters are Suitable for Direct Disposal

EPRI analyses suggest that at least some of the existing dual-purpose canisters (DPCs) used by the nuclear industry could be safely transported, aged, and disposed of at Yucca Mountain. Currently licensed DPCs hold approximately 1.14 to 1.55 times as much SNF as do TADs. Thus, using TADs instead of DPCs will result in 1.14 to 1.55 times as many canisters being loaded at nuclear utility sites, transported to Yucca Mountain, potentially aged, and eventually emplaced in the repository.

Potential impact on occupational health:
The DOE decision to not consider direct disposal of DPCs in its License Application imposes significant unnecessary occupational health risks on workers associated with the operations needed to open the loaded DPCs, transfer the CSNF to a TAD canister, manage the empty DPCs as low-level radioactive waste (LLW), and close the newly loaded TAD. Also significant would be the additional occupation risks borne by workers due to the need for additional loading TAD canisters arising from the limited capacity of the TAD versus larger capacity DPCs.

1.1.2 The Size of the Proposed Transportation, Aging, and Disposal Canisters is Smaller than is Necessary

DOE has proposed the use of transportation, aging, and disposal canisters (TADs) such that the utilities would load commercial spent nuclear fuel (CSNF) into the TAD canisters at the reactors, and with appropriate transportation, aging, and disposal overpacks, the TAD canisters would not need to be reopened after closure at the reactor sites. DOE also proposed to use TAD canisters for CSNF it will receive at Yucca Mountain from the utilities that would arrive in shipping containers other than TADs. The proposed capacity of the TADs is 21 pressurized water reactor (PWR) assemblies or 44 boiling water reactor (BWR) assemblies. Assuming DOE and the utilities reach agreement on the use of TADs at reactor sites, the sizes of the TADs are smaller than is necessary to reliably meet EPA and NRC regulatory performance criteria. EPRI analyses suggest that TADs could be up to 1.55 times larger without impinging on overall repository performance or exceeding thermal design limits. Thus, using TADs instead of DPCs will result in up to 1.55 times as many canisters being loaded at nuclear utility sites, transported to Yucca Mountain, potentially aged, and then disposed.

Potential impact on occupational health:
Using the proposed 21P/44B TAD size compared to use of a larger TAD, with a capacity that is similar to larger capacity DPCs currently in use for on-site dry storage, will result in additional unnecessary radiological and non-radiological risks borne by workers at utility sites, at Yucca Mountain itself, and in the transportation sector. These impacts result from the need for additional activities associated with canister loading, transport, and handling at Yucca Mountain. Each additional waste package will require excavation of an additional length of emplacement drift. Additional installation of drift hardware (invert, pallet, drip shield) and subsurface infrastructure (rock bolts, tunnel (mesh) liner), along with additional person-hours of labor associated with all aspects of handling, maintenance, inspection, and emplacement. In additional, manufacturing of additional repository system components for waste packages and developed drift components, will incur additional occupational risk during their manufacture and transport.

1.1.3 DOE Underestimated the Amount of Commercial Spent Nuclear Fuel Arriving at Yucca Mountain not in TADs

Even assuming the use of TADs, DOE has underestimated the amount of commercial spent nuclear fuel (CSNF) that would be shipped to Yucca Mountain in non-TADs. While DOE estimates a base case of 10% and a maximum of 25% of the CSNF would be shipped in non-TADs, EPRI estimates that more than 25% of the CSNF will already have been placed in non-TAD containers. At present, the DOE and utilities have not entered into specific agreements regarding the use of TADs for Yucca Mountain disposal, yet the proposed action does not specifically provide for CSNF acceptance in any form other than in TADs or as bare fuel.

Potential impact on occupational health:
Since DOE has underestimated the amount of CSNF that will be stored in canisters other than TADs at the reactor sites (mostly in DPCs), it may be necessary for workers to open and unload even more DPCs than discussed in Section 1.1.1. The use of additional TADs and the potential need to repackage CSNF already in DPCs at Yucca Mountain, and potentially at the utility sites, will cause increases in potential occupational hazards with respect to the reopening and unloading of existing DPCs, CSNF transfer from the DPCs into TADs, TAD closure, and

preparation of the TAD and its transportation overpack for shipment of CSNF to Yucca Mountain. In addition, there would be additional handling of CSNF in more TADs (relative to the number of DPCs due to the TADs' lower CSNF capacities) at Yucca Mountain. By requiring that only a fraction of the CSNF that will exist in DPCs or other storage canisters can be shipped to Yucca Mountain without repackaging into TADs, there will be increased occupational risks associated with additional handling of CSNF in DPCs including radiological and non-radiological risks.

1.1.4 The Probability of Igneous Activity within the Repository Footprint has been Overestimated

EPRI has determined that the probability of an igneous event intersecting the Yucca Mountain repository is less than 10^{-8} per year. As such, potential consequences of igneous activity need not be presented in DOE's license application per the draft 40 CFR 197 Yucca Mountain regulation. Furthermore, EPRI has determined that DOE's estimates of consequences due to igneous eruption and intrusion scenarios have been overstated.

Potential impact on occupational health:
Including igneous consequence analysis in the Yucca Mountain licensing proceedings could cause unnecessary delays in the licensing proceedings by deflecting attention from questions critical to developing an adequate understanding of the expected features, events, and processes. This could cause nuclear utilities to have to load and store additional spent nuclear fuel at the reactor sites, leading to additional radiation dose to both workers and the public nearby to the spent fuel storage facilities. In addition, workers involved with loading and transferring spent fuel storage casks at the utility sites would be exposed to additional, non-radioactive hazards involved with potential accidents leading to worker injury.

1.1.5 Drip Shields are Unnecessary

There are several conservatisms in DOE's analyses of post-closure performance that have led DOE to unnecessarily include drip shields in its repository design.

- Overestimation of the amount of net infiltration thereby incorrectly indicating a larger benefit of the use of a drip shield than is actually the case;
- Overestimation of the fraction of the repository experiencing seepage into the open drifts, having the same effect as overestimation of net infiltration;
- Overestimation of seismic energy and rockfall. This leads DOE to the conclusion that drip shields would provide significant protection from rockfall;
- Overestimation of damage to the TADs due to seismic and rockfall events. This also leads to the incorrect conclusion that drip shields would provide additional protection from damage of the waste packages;
- Overestimation of the rate at which Alloy 22 will degrade. This, in turn, gives greater performance credit to the drip shields than is warranted. This could lead to additional, unnecessary regulatory scrutiny that could delay the licensing process;
- Cladding performance has been neglected. EPRI analyses indicate that including cladding performance would provide an additional barrier to the release of radionuclides from the waste form. This would also reduce the need for a drip shield;

- DOE notes that it typically uses the more conservative of two or more conceptual models. Some of these conservatisms could also result in the apparent need for drip shields.

Potential impact on occupational health:
The construction, transportation, and installation of drip shields would cause unnecessary, radiological and non-radiological occupational health hazards. Mining of titanium, conversion to metal, and manufacture of the drip shields would cause unnecessary industrial hazards to the relevant workers and will put pressure on available titanium resources. Installation of the drip shields would also impose unnecessary risks to Yucca Mountain workers.

1.1.6 The Surface Facilities have been Overdesigned to Withstand Seismic Ground Motion

DOE has assessed the risk of seismic ground motion during the pre-closure period. While it is certainly necessary to design systems, structures, and components to withstand this risk, EPRI believes DOE's surface facility is overdesigned for this risk. This has led to an unnecessarily large, robust surface facility structures and elements.

Potential impact on occupational health:
Additional health risks to workers and the public caused by the construction of over-designed surface and sub-surface facilities would be caused by, for example, transportation and use of additional construction materials and additional, unnecessary construction activities.

1.1.7 DOE Overestimated the Seismic Energy that is Possible During the Post-closure Period

EPRI contends that DOE's estimates of seismic energy risk at Yucca Mountain are overstated – especially for the long recurrence interval seismic events. Because DOE has overestimated seismic energy, it has also overestimated the amount and timing of rockfall (especially during the time period shortly after repository closure). This has led to an overestimate of dose to the public in DOE's analyses, especially for early times after repository closure.

Potential impact on occupational health:
This could also cause a delay in the availability of the Yucca Mountain repository if, for example, DOE needs to perform additional, unnecessary construction tasks to accommodate DOE's overestimate of seismic energy. Furthermore, EPRI feels that one of the reasons DOE has specified a very robust TAD design is to mitigate damage to the TAD overpack that could be caused by the seismic energy overestimates. Additional delays in the ability to move CSNF from reactor sites to the Yucca Mountain repository could be caused by the need to develop, license, construct, load, and dispose of unnecessarily robust TAD canisters and overpacks. Delays in the ability to move CSNF to Yucca Mountain could cause both occupational and public radiological and non-radiological health hazards.

1.1.8 Co-disposal versus TAD Waste Package Design and/or Analysis Caused the Peak Dose to be Driven by Co-disposal Waste Packages

It appears that DOE's TSPA indicates the first peak in post-closure dose is due primarily to the relatively early failure of the co-disposal waste packages compared to the now very robust TAD waste packages for CSNF. The first peak is roughly the same magnitude as the peak due

primarily to TAD failure many hundreds of thousands of years in the future. There are also conservatisms in how DOE calculates the peak dose for the co-disposal waste packages.

Potential impact on occupational health:
The fact that DOE has estimated the peak dose due to co-disposal waste packages is roughly the same as from the TADs containing CSNF may cause unnecessary regulatory scrutiny, thereby leading to potential licensing delays. Occupational health impacts due to delays in opening the repository have been discussed earlier.

1.1.9 The Spacing between Disposal Drifts is Unnecessarily Large

DOE's drift center-to-center spacing requirement of 81 meters is based on conservative estimates of temperature in the rock pillars over time, as well as the artificially imposed requirement of keeping some of the rock pillar below boiling temperatures at all times. The result of the unnecessarily large drift spacing is that more rock will need to be excavated, and more rock supports will need to be installed than is actually necessary.

Potential impact on occupational health:
Excavation of additional rock and installation of additional rock supports will increase both the radiological and non-radiological hazard to workers excavating the drifts and installing the rock support, as well as occupational and public health hazards due to the transportation of extra rock support materials;

1.1.10 The Waste Handling Facility Throughput DOE proposes is Insufficient to Process the CSNF that will be Shipped to Yucca Mountain not in TADs

As discussed above, EPRI concludes there will be more CSNF shipped to Yucca Mountain that would need to be processed in DOE's Wet Handling Facility (WHF) than DOE is planning in its Proposed Action. Either DOE will need to construct additional WHFs or it will take longer to process the larger amount of CSNF in one WHF.

Potential impact on occupational health:
If all 63,000 MTHM of CSNF is to be processed in 24 years as DOE proposes, additional WHFs will have to be constructed, with the concomitant increase in occupational health risks due to material fabrication and transportation, and construction activities. Additional WHF construction will likely lead to a delay in the ability to transfer CNSF from reactor sites to Yucca Mountain. Alternatively, if just one WHF is constructed, the it will require additional processing time, which could cause nuclear utilities to have to load and store additional spent nuclear fuel at the reactor sites, leading to additional radiation dose to both workers and the public nearby to the spent fuel storage facilities. In addition, workers involved with loading and transferring spent fuel storage casks at the utility sites would be exposed to additional, non-radioactive hazards involved with potential accidents leading to worker injury.

1.1.11 Conservatisms in DOE Analyses Led to an Overestimate of Post-closure Dose

EPRI has determined that DOE's TSPA has incorporated many conservatisms that have led DOE to overestimate dose rates to the RMEI during the post-closure period. These many conservatisms cannot simply be considered independently, since many conservatisms compound with others, so that the net effect is greater than each taken individually.

Potential impact on occupational health:
Because DOE's multiple conservatisms cause DOE to overestimate dose rates to the RMEI, the repository system design may be more robust than a repository design based on a different design based on more reasonable assumptions and data inputs to DOE's dose assessment calculations. Secondarily, the loss of margin below the draft EPA and NRC dose limits has the potential to increase the licensing process. Either of these causes could lead to a delay in the availability of Yucca Mountain. Any delay in the licensing, construction, and operation of the repository places additional radiological and non-radiological risk burdens on workers at the utility sites due to the need to construct additional ISFSI capacity; to extend and/or expand inspection and maintenance programs for existing ISFSI facilities at operating plants.

1.2 Approach

EPRI's approach in developing the analyses in this report was to utilize, as possible and appropriate, cautious but realistic assumptions in the performance of its various analyses and investigations, as recommended by the National Academy of Sciences in its *Technical Bases for Yucca Mountain Standards* report (NAS, 2005). For example:

- Occupational risk is considered only for involved workers, although it is recognized that each additional unit of activity requires the support of professionals and other ancillary staff that are not directly exposed to the hazards of the work site but still incur risk associated with office settings and travel to and from work. These additional workers are typically referred to a "non-involved workers."
- Whenever possible and where deemed appropriate, EPRI utilized DOE data and estimates obtained from the various Yucca Mountain related documents such as the Environmental Impact Statements, the License Application itself, and supporting documents and calculation packages. This was done in order for EPRI to be able to make direct comparison between its assessment of worker risk and the risk calculations contained in the DOE documents. In the event that the DOE data and estimates were not available or are did not provide enough supporting detail to allow for derivative analysis, EPRI used publicly available data from the U.S. Nuclear Regulatory Commission (NRC), Bureau of Labor Statistics (BLS), and other citable sources.
- DOE performed a detailed assessment of impacts to workers at nuclear power plants sites and DOE sites in its analysis of the No Action Alternative for the Yucca Mountain EIS, as supplemented. EPRI relied on some of the at-reactor worker impacts utilized by DOE in its No Action Alternative analysis. When available, EPRI has also identified other citable sources of data associated with worker impacts at nuclear power plant sites.
- Collective occupation dose is the primary metric used in this report for tracking radiological risk burdens as it provides a convenient means for tracking such risks to workers without the need to make assumptions about how a company, utility, or DOE contractor divides that burden among its workforce. While the use of collective dose has important limitations, here it is used as exclusively an accounting tool and not for causally linking specific health effects to low exposures.
- Radiological hazards to workers during transport are evaluated for accident free transport only. Radiological exposure associated with transportation accidents is not considered.
- Transportation accidents are considered for evaluating non-radiological risks to workers.

- Non-radiological hazards are primarily tracked via the standard Bureau of Labor Statistics categorization of total recordable cases (TRC), and lost workday cases (LWC). and fatalities and are typically indexed to full-time equivalent.worker years (FTE).
  - Total Recordable cases include Recordable cases include work-related injuries and illnesses that result in one or more of the following: death, loss of consciousness, days away from work, restricted work activity or job transfer, medical treatment (beyond first aid), significant work-related injuries or illnesses that are diagnosed by a physician or other licensed heath care professional
  - Lost work-time cases include all cases involving days away from work, or days of restricted work activity, or both.
  - Fatalities include all cases of work related deaths.
  - Non-radiological health and safety data are presented either as a rate (number of cases per X number of FTE) or as total number of cases.
  - A full-time equivalent worker year is equivalent to 2,000 work hours, i.e., the typical number of hours for a typical worker year comprised of 8 hours per day, 50 weeks per year.

The occupational health impacts resulting from the approaches taken by DOE in its Yucca Mountain design, analyses and operations are estimated in Appendices B and C of this report, with supporting data presented in Appendices A, D, and E.. Most estimates are provided on a generic basis using the best available data and what are deemed to be reasonable assumptions. These estimates are then used to calculate overall impacts to the extent data and assumptions allow. However, in some cases, the estimated impacts may be provided for "unit" increments of:

1. Time (for example, the impact due to a delay of opening the repository by one year);
2. Individual operational steps (for example, the occupational impact of loading one additional TAD canister);
3. Length of access or disposal drifts (for example, the occupational impact of having to excavate and develop an extra one meter of drift); or
4. Facility construction units, such as the construction of one additional Wet Handling Facility or the use of additional concrete and building materials.

These unit values are used, when possible, to estimate the occupational health effects for each one of the issues in the following chapters.

2
SOME DUAL-PURPOSE CANISTERS (DPCS) ARE SUITABLE FOR DIRECT DISPOSAL

2.1 Technical Bases

The License Application states that DOE has rejected the idea of directly disposing of *any* DPCs in favor of repackaging the CSNF into TADs prior to disposal:

> DPCs are currently used by several utilities to store and potentially ship commercial SNF. Currently licensed DPCs have not been shown to be suitable for disposal purposes. However, although not currently acceptable under the provisions of 10 CFR Part 961, the DOE may choose to receive DPCs at the repository and repackage the commercial SNF into a TAD canister for disposal after the execution of mutually agreeable amendments to the utilities disposal contract. (DOE 2008b, Section 1.5.1.1.1.2.1.2)

DOE also defines a "disposable canister" as:

> A metal vessel for commercial and DOE spent nuclear fuel assemblies ... or solidified high-level radioactive waste suitable for storage, shipping, and disposal. At the repository, DOE would remove the disposable canister from the transportation cask and place it in a waste package. There are a number of types of disposal canisters, including DOE standard canisters, multicanister overpacks, naval spent nuclear fuel canisters, and TAD canisters. (DOE 2008d, Section 2.1.1)

EPRI evaluated the possibility of the larger DPCs meeting DOE's criterion for a "disposable canister" against several criteria (EPRI, 2008a):

- Size -- to determine if the inner DPC canister plus a modified disposal overpack (modified to fit the DPC canister, but otherwise dimensionally consistent with the proposed TAD design) will fit inside the proposed disposal drift diameter, and still allow room for installation of the invert, pedestal, drip shield, and rock support;
- Rock wall temperature -- to determine if direct disposal of DPCs will cause rock wall temperatures to exceed ~200°C. This temperature limit is a reasonable upper bound that would prevent significant rock expansion leading to potentially significant rock spallation. However, previous EPRI analysis suggests this temperature limit could be increased to ~225°C (EPRI, 2006a), if necessary.
- Seismicity and rockfall – to determine if there are any special issues with respect to the ability of DPCs to withstand anticipated seismic and rockfall events;
- Pillar dry-out – to determine if the water saturation in some of the rock between the disposal drifts remains above zero, thereby allowing passage of groundwater infiltrating from above the repository to below the repository. While beneficial, EPRI contends that it is not necessary to maintain water saturation in the pillar above zero at all times (EPRI, 2006a; 2007a);

- Criticality – to determine if DPCs in appropriate disposal overpacks will remain sub-critical during the post-closure period, or if critical for some scenarios, whether the canisters are likely to become prompt critical (EPRI, 2007b; 2008a); and
- Long-term dose to the RMEI (reasonably maximally exposed individual) – to compare the peak RMEI dose in the post-closure period due to the disposal of CSNF in DPCs with disposal overpacks with that due to the disposal of TADs.

EPRI (2008a) and EPRI (2007b) find there are no known technical barriers to direct disposal of at least some of the DPCs. Peak temperatures at the rock wall and in the rock pillars will not exceed values to cause excessive rock spalling and pillar dry-out, respectively:

> Direct DPC disposal was examined to determine if there would be any significant issues relative to thermal effects, thermal-mechanical effects, corrosion, TSPA of the nominal repository evolution scenario and credible alternative repository evolution scenarios, as well as criticality. It is concluded that there are very small differences in performance of DPCs in the post-closure period compared to performance of TADs. Criticality is also extremely unlikely for both TADs and DPCs. No obstacles have been identified that would preclude the use of DPCs for disposal of commercial spent nuclear fuel (CSNF) in a geologic repository at Yucca Mountain. ...
>
> Both TADs and a significant portion of the DPCs that will exist at the time of TAD availability are disposable. For the sizeable inventory of CSNF already safely sealed in DPCs, EPRI believes that ... a substantial inventory of dual-purpose casks, which are designed for storage and transport, could be certified for disposal at Yucca Mountain based on performance based criteria.

Therefore, EPRI argues that at least some of the DPCs anticipated to be in existence at the time DOE is ready to accept CSNF at Yucca Mountain *can* be disposed of directly by inserting them inside an appropriate Alloy 22 outer canister.

2.2 Occupational Health Risk Impacts

The DOE decision to not consider direct disposal of any DPCs in its License Application imposes significant unnecessary occupational health risks on workers associated with the operations needed to open the loaded DPCs, transfer the CSNF to a TAD canister, manage the empty DPCs as low-level radioactive waste (LLW), and close the newly loaded TAD. Also, significant additional occupation risks would be borne by workers due to the need for additional loading TAD canisters arising from the limited capacity of the TAD versus larger capacity DPCs.

The occupational health impacts caused by the need to transfer CSNF from the DPC into TADs, presumably at Yucca Mountain, are described in detail in Appendices B and C. Some key impacts are summarized in Table 2-1. For DPC systems transported to Yucca Mountain and unloaded, rather than being placed in waste packages for direct disposal, a net additional worker dose of 135 person-mrem per package (260 person-rem – 125 person rem from Table B-6) is incurred (Table B-8). Accordingly, this same dose also represents the potential dose avoided per canister if DPCs or other existing, loaded canister systems were qualified by DOE for direct disposal.

Table 2 - 1
Net Occupational Doses Associated with Unloading and Disposal of DPCs

DPC scenario	Number of DPCs for Receipt at Yucca Mountain	Worker Dose Associated with DPC Unloading (person-rem)	Worker Dose Associated with DPC Waste Management (person-rem)
DOE baseline	307	80	14
DOE high estimate	966	250	43
EPRI high estimate	2375	620	110

Likewise, each emptied DPC (or other canister) will need to be managed as LLW, incurring estimated additional doses to workers of 0.045 person-rem for each DPC discarded. Thus, the dose in Table 2-1 represents both the estimated dose to workers associated with LLW management activities under the DOE proposed operational approach and the dose that could be avoided if DPCs or other existing, loaded canister systems were employed for direct disposal in Yucca Mountain.

The additional handling steps associated with unloading and disposing of DPCs also pose additional potentially unnecessary occupational risk to workers at Yucca Mountain (or reactor sites should unloading operations be required prior to shipment). EPRI was not able to develop specific estimates for these impacts, but the DOE considers the following industrial injury and fatality rates for workers at Yucca Mountain during operations:

- TRC 1.4 per 100 FTE
- LWC 0.58 per 100 FTE
- Fatalities 0.55 per 100,000 FTE

3
TAD CANISTER CAPACITY IS SMALLER THAN NECESSARY FOR DISPOSAL

EPRI analyses conclude that the Transportation, Aging, and Disposal (TAD) canisters and disposal overpacks are smaller than could be used for disposal at Yucca Mountain. Thus, the sizes of the TADs are smaller than necessary. As discussed in EPRI (2008a) and summarized in Section 2.1 of this report, EPRI finds that many of the existing dual-purpose canisters (DPCs) used by the nuclear industry could be safely transported, aged, and disposed of at Yucca Mountain. Currently licensed DPCs hold approximately 1.14 to 1.55 times as much spent nuclear fuel as do the proposed TADs. Thus, using the proposed TAD size instead of DPCs or larger capacity TADs will result in a larger number of canisters being loaded at nuclear utility sites, transported to Yucca Mountain, potentially aged, and then disposed of in the repository.

Section 3.1 makes the argument that TADs capacities could be at least as large as DPCs that have a capacity of 1.5 times that of the DOE-proposed TAD capacities. Section 3.2 discusses the avoidable occupational health risks by increasing the capacity of the TADs by a factor of 1.5.

3.1 Technical Bases

DOE proposes to use TADs for the transportation, aging, and disposal of CSNF (DOE, 2008b). The proposed TAD canisters would hold 21 PWR assemblies or 44 BWR assemblies. This TAD size is termed a "21P/44B". While EPRI agrees that TADs of this size can be safely transported, aged, and disposed of at Yucca Mountain, it is also possible to use larger waste packages (including both the inner canisters and the relevant overpacks for transportation, aging, or disposal).

U.S. nuclear utilities are currently using a variety of CSNF dry storage systems at their reactor sites. The earliest dry storage systems were designed for storage-only operations; later designs are almost exclusively "dual-purpose" canisters – designed for both dry storage and transportation. However, most DPCs are currently certified for storage only. Many of the utilities using the storage-only systems have or are in the process of submitting license applications to the NRC to certify these systems for transport. While a handful of the earliest storage-only systems are smaller than the 21P/44B TAD capacity, the majority of storage-only and DPCs are larger than 21P/44B.

Section 2.1 summarizes EPRI's conclusion that some DPCs could be considered "disposable canisters". EPRI considered a DPC capacity 1.5 times as large as the DOE-proposed 21P/44B TAD. Given that EPRI concludes some of the larger DPCs can be directly disposed of (EPRI, 2008a), EPRI argues that larger TAD capacities could have been selected by DOE based on findings from EPRI's evaluation of larger DPCs for direct disposal, which apply to large TAD designs as well.

EPRI evaluated the possibility of direct disposal of the larger DPCs against several criteria (EPRI, 2008a):

- Size -- to determine if the inner DPC canister plus a modified disposal overpack (modified to fit the DPC canister, but otherwise dimensionally consistent with the proposed TAD design) will fit inside the proposed disposal drift diameter, and still allow room for installation of the invert, pedestal, drip shield, and rock support;
- Rock wall temperature -- to determine if direct disposal of DPCs will cause rock wall temperatures to exceed ~200°C. This temperature limit is a reasonable upper bound that would prevent significant rock expansion leading to potentially significant rock spallation. However, previous EPRI analysis suggests this temperature limit could be increased to ~225°C (EPRI, 2006a), if necessary.
- Seismicity and rockfall – to determine if there are any special issues with respect to the ability of DPCs to withstand anticipated seismic and rockfall events;
- Pillar dry-out – to determine if the water saturation in some of the rock between the disposal drifts remains above zero, thereby allowing passage of groundwater infiltrating from above the repository to below the repository. While beneficial, EPRI contends that it is not necessary to maintain water saturation in the pillar above zero at all times (EPRI, 2006a; 2007a);
- Criticality – to determine if DPCs in appropriate disposal overpacks will remain sub-critical during the post-closure period, or if critical for some scenarios, whether the canisters are likely to become prompt critical (EPRI, 2007b; 2008a); and
- Long-term dose to the RMEI (reasonably maximally exposed individual) – to compare the peak RMEI dose in the post-closure period due to the disposal of CSNF in DPCs with disposal overpacks with that due to the disposal of TADs.

EPRI (2008a) and EPRI (2007b) find there are no known technical barriers to direct disposal of at least some of the DPCs. Peak temperatures at the rock wall and in the rock pillars will not exceed values to cause excessive rock spalling and pillar dry-out, respectively.

3.2 Potential Impacts of Using a Smaller TAD

Using the proposed 21P/44B TAD size compared to use of a larger TAD, with a capacity that is similar to larger capacity DPCs currently in use for on-site dry storage, will result in additional unnecessary radiological and non-radiological risks borne by workers at utility sites, at Yucca Mountain itself, and in the transportation sector. These impacts result from the need for additional activities associated with canister loading, transport, and handling at Yucca Mountain.. Each additional waste package will require excavation of an additional length of emplacement drift. Additional installation of drift hardware (invert, pallet, drip shield) and subsurface infrastructure (rock bolts, tunnel (mesh) liner), along with additional person-hours of labor associated with all aspects of handling, maintenance, inspection, and emplacement. Furthermore, manufacturing of additional repository system components for waste packages and developed drift components, will incur additional occupational risk during their manufacture and transport.

EPRI evaluated the potential occupational health and safety impacts associated with DOE's decision to exclusively use the proposed 21P/44B TAD rather than use of larger TAD designs. For the reactor site and transportation activities, these effects are the same as for DOE's decision

to not consider direct disposal of larger DPCs. This is because it is assumed that the transfer of CSNF from DPCs to TADs would occur at Yucca Mountain, per DOE's Proposed Action.

The evaluation considered here uses two alternative scenarios, EPRI Case 1 and EPRI Case 2. Case 1 assumes that larger (32-PWR/68-BWR) TADs are deployed for loading of fuel at reactor sites, leading to concomitant reductions in loading operations, shipments, handling, and drift length. Case 2 extends Case 1 further to exclude the exclusive truck shipments from seven reactor sites that are assumed in DOE's baseline estimate. The resulting occupational impacts are summarized in Table 3-1 below.

The basis for these estimates are provided in Appendices A, B. and C for quantities of required canisters/casks, radiological impacts, and non-radiological impacts respectively.

Table 3 - 1
Radiological and Non-Radiological Impacts of Using TADs that are Smaller than Necessary

Affected Worker Population	EPRI Scenario for Comparison	Source of Impact	Additional Cumulative Dose (person-rem)	Additional Injuries and Fatalities
Reactor sites	Case 1	21P/44B TAD capacity results in additional canister loading	2,028 Table B-2	19 TRC 13 LWC 0.04 fatalities
	Case 2	21P/44B TAD capacity and assumption of 7 nuclear plants shipping by truck results in additional package loading	2,813 Table B-2	31 TRC 21 LWC 0.07 fatalities
Transportation	Case 1	21P/44B TAD capacity results in additional shipments of CSNF to the repository	1,174 Table B-5	Rail accident: 1.15×10^{-8} fatality/ railcar-km For shipments involving 3 CSNF casks (8 railcars total), the fatality rate was estimated to be 9.20×10^{-8} accidents/train-km
	Case 2	21P/44B TAD capacity and assumption of 7 nuclear plants shipping by truck results in additional shipments of canisters	1,783 Table B-5	Truck accident 5.34E-07 accidents per truck km 1. 55E-08 fatalities per truck km

Table 3-1 (continued)

Affected Worker Population	EPRI Scenario for Comparison	Source of Impact	Additional Cumulative Dose (person-rem)	Additional Cumulative Dose (person-rem)
Yucca Mountain operations	Case 1	21P/44B TAD capacity results in additional canisters for receipt and handling	701 Table B-7	1.4 TRC per 100 FTEs 0.58 LWC per 100 FTE 0.55 fatalities per 100,000 FTW worker years
	Case 2	21P/44B TAD capacity and assumption of 7 nuclear plants shipping via truck casks results in additional packages for receipt and handling	1,792 Table B-7	1.4 TRC per 100 FTEs 0.58 LWC per 100 FTE 0.55 fatalities per 100,000 FTW worker years
Yucca Mountain subsurface construction	Case 1	Drift excavation to accommodate additional CSNF waste packages	155	18 TRC 7.7 LWC 0.0049 fatalities
	Case 2	Drift excavation to accommodate additional CSNF waste packages	166	19 TRC 8.2 LWC 0.0052 fatalities

Other Health and Economic Impacts

Additional Radiological Health Impacts to Workers at Reactor Sites Associated with Unloading Storage-Only Dry Storage Systems

While the YMSEIS did not calculate the worker dose associated with unloading CSNF in dry storage at reactor sites for repackaging prior to shipment to Yucca Mountain, it is possible that some of these packages would be unloaded at reactor sites. EPRI assumes that industry workers would incur a dose of 260 person-mrem per package unloaded, as identified in B-1. If storage only casks must be unloaded, this will result in an estimated worker dose of 83 person-rem. If dual-purpose metal casks must be unloaded at reactor sites, the estimated worker dose would be 35 person-rem. If DPCs and storage-only canisters are unloaded at reactor sites for repackaging, the estimated worker dose would be 617 person-rem. (Table B-4)

Radiological Health Impacts to the Public During TAD Transportation from the Reactor Sites to Yucca Mountain :

Incident-Free Transportation Radiation Doses:

- Rail: 800 person-rem
- Truck: 350 person-rem

The use of higher capacity TAD designs as well as the shipment of CSNF in higher capacity TAD designs from sites identified by DOE as truck sites, would result in fewer packages being shipped. This would result in a proportional decrease in the incident-free dose to the public similar to the reduction in worker dose during transport discussed in Appendix B.

Non-radiological Impacts to the Public during TAD and Ancillary Equipment Transport to Reactor Sites

The YMSEIS assumed that approximately 6,500 empty TAD canisters would be shipped to commercial reactor sites by truck under the 70,000 MTU repository scenario. In addition to the shipment of TADs, approximately 4,900 kits of ancillary equipment needed for loading at reactor sites would also be shipped. DOE assumed that a total of 1.2 traffic fatalities would result from these shipments and 0.23 fatalities from vehicle emissions (assuming a shipping distance of 3,000 kilometers per shipment). (DOE 2008a, Section 6.2.1). If higher capacity TAD canisters were used to load CSNF as described by EPRI Case 1 or EPRI Case 2, a fewer number of TAD canisters and ancillary equipment would need to be transported resulting in a smaller number of vehicle fatalities and vehicle emission fatalities,

Economic Impacts

Increase in costs associated with DOE's proposal to use 21P/44B TADs compared to EPRI Case 1:

▪ At reactor loading costs	$0.38 billion
▪ Transport costs	$0.33 billion
▪ Disposal costs (TAD canisters and waste packages	$3.14 billion
▪ Total potential cost impacts:	$3.85 billion

Increase in costs associated with DOE's proposal to use 21P/44B TADs compared to EPRI Case 1:

▪ At reactor loading costs	$0.44 billion
▪ Transport costs	$0.41 billion
▪ Disposal costs (TAD canisters and waste packages)	$3.33 billion
▪ Total potential cost impact	$4.18 billion

3.4 Summary of Impacts

Using the proposed 21P/44B TAD size compared to use of a larger TAD will result in increases in radiological and non-radiological risks borne by workers at utility sites, at Yucca Mountain itself, and in the transportation sector. These impacts result from the need for additional activities associated with canister loading, transport, and handling at Yucca Mountain.

As shown in Table 3-1, comparing DOE's proposed 21P/44B TAD scenario with EPRI Case 1, worker dose would increase by by 2,028 person-rem due to increased at-reactor package loading; by 1,174 person-rem due to transportation of additional casks; by 701 person-rem due to increased CSNF receipt and handling at Yucca Mountain; and by 155 person-rem to to increased drift excavation to emplace additional waste packages. Compared to EPRI Case 1, DOE's proposal to use the 21P/44B TAD canister for transport, aging and disposal could result in a 4,058 person-rem increase in worker dose.

As shown in Table 3-1, comparing DOE's proposed 21P/44B TAD scenario with EPRI Case 2, worker dose would increase by 2,813 person-rem due to increased at-reactor package loading; by 1,783 person-rem due to transportation of additional casks; by 1,791 person-rem due to increased CSNF receipt and handling at Yucca Mountain; and by 166 person-rem to to increased drift excavation to emplace additional waste packages. Compared to EPRI Case 2, DOE's proposal to use the 21P/44B TAD canister for transport, aging and disposal could result in a 6,553 person-rem increase in worker dose.

4

DOE ASSUMES TOO FEW NON-TAD SHIPMENTS TO YUCCA MOUNTAIN

4.1 Technical Bases

The YMSEIS (DOE, 2008d) assumes that a total of 307 DPCs and storage-only canister-based systems would be shipped to the repository and unloaded at the repository under the 70,000 MTU repository case. In the case that assumes all CSNF is accepted at the repository (referred to in the YMSEIS as Module 1), a total of 966 DPCs are assumed to be shipped to the repository and unloaded at the repository. (DOE, 2008d, Section A.2, Table A-3)

A discussed in more detail in Section A.2, EPRI estimates that utilities could load as many as 2,155 DPCs at reactor sites through 2020. Utilities have also loaded 220 canister-based storage-only dry storage systems – the YMSEIS assumes that some of these canisters would be transported to the repository for repackaging at the repository. Thus, EPRI estimates that as many as 2,375 DPCs and canister-based systems could be storing CSNF by 2020.

4.2 Potential Impacts Associated with Unloading Dual-Purpose Metal Casks and Storage-Only Casks

As discussed in more detail in Appendix A, the YMSEIS does not assume that CSNF stored in dual-purpose metal casks or storage-only metal casks will be transported to the repository and repackaged at repository surface facilities. Therefore, EPRI estimated a worker dose of 35 person-rem associated with unloading dual-purpose metal casks and 26 person-rem associated with unloading storage-only metal casks at reactor sites for repackaging prior to transport to the repository. As noted above, the YMSEIS assumed that 307 to 966 DPCs and/or storage-only canister systems will be transported to the repository for repackaging under the 70,000 MTU repository scenario and the full MTU (DOE 2008d, Module 1) scenario, respectively.

4.3 Potential Impacts due to DOE Assumption of too Few Non-TADs

EPRI estimates that as many as 2,375 DPCs and storage-only canisters could be in use at reactor sites by 2020. If these systems had to be unloaded at reactor sites for repackaging prior to transport, EPRI estimates a unit worker dose of 260 person-mrem per package unloaded, which results in worker doses of 57 person-rem and 560 person-rem for with unloading storage-only canister systems and DPCs, respectively. Thus, if as many as 2,155 DPCs were unloaded at reactor sites, worker dose would increase by 796 person-rem relative to DOE's baseline scenario (307 DPCs; Table A-3) and by 309 person-rem compared to DOE's high-DPCs scenario (966 DPCs; Table A-3). Appendix B.1.4. provides more detail on this estimate.

Occupational Health Impacts at the Reactor Sites

Radiological Impacts:

Table 4-1 summarizes the radiological impacts associated with unloading of various canister systems at the reactor sites.

Table 4 - 1
Radiological Impacts Associated with Unloading of Various Canister Systems at Reactor Sites

Canister System	Worker Dose (person-rem)
307 DPCs/storage-only canisters	80
966 DPCs/storage-only canisters	251
2,375 DPCs/storage-only canisters	560
135 dual-purpose metal casks	35
101 storage-only metal casks	26

Occupational Health Impacts at Yucca Mountain

Radiological Impacts:

- Increased dose associated with unloading DPCs at Yucca Mountain: 135 person-mrem per additional DPC unloaded
- 966 DPCs unloaded compared to 307 DPCs/storage-only canisters assumed in YMSEIS: 89 person-rem
- 2,375 DPCs and storage only canisters unloaded compared to 307 DPCs/storage-only canisters assumed in YMSEIS: 280 person-rem

5
DOE OVERESTIMATED THE PROBABILITY OF IGNEOUS ACTIVITY

5.1 Technical Bases

The geological setting surrounding Yucca Mountain contains several extinct volcanic centers formed over the last 12 million years. DOE has conducted numerous surface and sub-surface investigations of exposed and buried volcanic features to develop a basis for judging the probability of a future volcanic (igneous) event intersecting the proposed Yucca Mountain repository. The results of these investigations have enabled DOE to conduct Probabilistic Volcanic Hazard Analyses (PVHA) to determine if the geological evidence supports a probability of future occurrence below or above the regulatory threshold for consideration of future scenario-initiating events, which is a future occurrence rate of 1 part in 10,000 for a 10,000 year period, or 10^{-8} per year (NRC, 2005). The License Application (DOE, 2008b) uses the probability value obtained in the 1996 PVHA Panel study of 1.7×10^{-8} per year (CRWMS M&O, 1996, pp. 4-1), which means this scenario of future volcanism narrowly exceeds the threshold for exclusion in licensing review.

EPRI has recently conducted (EPRI, 2008b, in preparation) an independent assessment of the likelihood of a future volcanic event occurring at the proposed Yucca Mountain repository site. The assessment methodology adopted in the EPRI study was based on same methodology applied in the 1996 Probabilistic Volcanic Hazard Analysis (PVHA) report (CRWMS M&O, 1996, pp. 2-19) and utilized in the LA as noted above. The purpose of EPRI's study was to independently develop new insights and probability estimates for future volcanism based on the more recent, extensive geological and structural data obtained during the last 12 years in the Yucca Mountain region (YMR), especially including recent determination of relatively ancient age (8-10 million years before present) for several buried anomalies in the Yucca Mountain region, which were undated and speculated to be of much younger age in the 1996 PVHA study.

EPRI's PVHA study includes consideration of new geochemical, geophysical, seismological, geodetic and age-dating data collected since the 1996 PVHA report (e.g., Brocher et al., 1998; Day et al., 1998; Perry et al. 1998; Fridrich, 1999; Fridrich et al. 1999; Potter et al., 2002; 2004; Perry et al., 2005; Valentine et al., 2005; 2006; Parson et al., 2006; Valentine and Krough, 2006; Valentine and Perry, 2006; Gaffney et al., 2007; Perry, 2007; Valentine and Perry, 2007; Valentine et al. 2007; Keating et al, 2008), in particular information from the drilling and characterization of various anomalous features buried under alluvial deposits that have been speculated from aeromagnetic data to be additional volcanic centers. Furthermore, EPRI's independent update to the 1996 PVHA report includes consideration of structural factors that demonstrably have controlled the actual eruptive location of volcanic centers that have occurred in the Yucca Mountain region in the last 12 million years (Valentine and Perry, 2006; 2007; Gaffney et al., 2007; Keating et al, 2007). As noted by the NRC's Advisory Committee and Nuclear Waste (ACNW) report on volcanism (ACNW, 2007, pp. 63), for example, there has been no igneous intrusion into Yucca Mountain block in the last 10 million years.

The approach taken by EPRI (EPRI, 2008b, in preparation) follows that used in the 1996 PVHA (CRWMS M&O, 1996). The approach involves defining an igneous event that may intersect the footprint of the proposed repository within the next 10,000 to 1,000,000 years. The calculation requires that an igneous event be well defined and its characteristic features be quantified, and the identification of factors that govern the location and timing of a possible future igneous event in the YMR. By following a similar approach as the 1996 PVHA calculation, results from EPRI's calculation may be compared and evaluated to results in the 1996 PVHA (CRWMS M&O, 1996) and a planned PVHA-U (the updated version of the 1996 PVHA) by the USDOE. Appendix F provides a more detailed discussion of the methodology EPRI used in its PHVA.

EPRI's independent PVHA work finds the 1.7×10^{-8} per year probability of a future igneous event intersecting the proposed Yucca Mountain repository used in DOE's TSPA License Application (OCRWM, 2008) to be an overestimate. A more reasonably expected value of 3.0×10^{-9} per year, with a range of 0.0 to 7.3×10^{-9} per year for the period between 10,000 and 1,000,000 following repository closure, is supported by recent independent analyses based on up-to-date, site-specific information and models (EPRI, 2008b, in preparation). The implication of this lower probability value is that consideration of future igneous/ volcanic events occurring at Yucca Mountain fall below the regulatory threshold for inclusion in licensing review.

5.2 Potential Impacts due to Overestimating the Probability of Igneous Activity

The draft EPA and NRC regulations for Yucca Mountain specify that if the probability of a particular event, such as igneous activity within the Yucca Mountain repository footprint, is less than one chance in 10,000 over 10,000 years, then the consequences of such an event need not be evaluated (EPA, 2005; NRC, 2005). DOE's overestimation of the probability of igneous activity at Yucca Mountain could lead to an outcome EPA specifically intended to avoid with its "reasonable expectation" approach, i.e., consideration of unlikely events at cost of "deflect[ing] attention from questions critical to developing an adequate understanding of the expected features, events, and processes."

Furthermore, the DOE estimates of igneous consequences in the licensing process may be subject to considerable regulatory scrutiny. The mean dose to the Reasonably Maximally Exposed Individual (RMEI) living downstream of Yucca Mountain due to igneous activity scenarios is the dominant contributor to overall dose to the RMEI from all scenarios[DOE LA, 2008b]. Therefore, NRC and, potentially, third parties to the licensing process may review the igneous consequence analysis work in great detail. This may extend the time to complete the licensing process.

It is difficult to link DOE's overestimation of the probability of igneous activity to specific outcomes of the licensing process that lead directly of negative impacts on worker health and safety. However, it is conceivable that by further complicating an already complex analysis and licensing task with inclusion of igneous activity its License Application, DOE has increased the likelihood that the shipment of CSNF from reactor sites and other commercial facilities will be subject to further delay. Any additional delay adds to the occupational health risk borne by workers at the storage sites.

The need to store additional amounts of CSNF for an additional amount of time will increase both radiological and non-radiological health risk primarily to workers at the reactor sites due to additional CSNF handling and monitoring in both dry and wet storage. Storage of additional

CSNF at reactor sites will also have a radiological impact on members of the public that may live near the at-reactor dry storage location(s).

For each year of delay in the start of acceptance of CSNF by DOE, nuclear utilities will have to load additional CSNF into dry storage canisters – most likely TAD canisters. Solely for the purposes of estimating occupational health risk consequences, EPRI assumes that once DOE begins repository operations, DOE would provide nuclear utilities with TAD canisters and transportation casks for shipment of CSNF offsite.

The NWPA limits Yucca Mountain capacity to 70,000 MTHM of CSNF and DOE spent nuclear fuel and HLW, 63,000 MTHM of which is available for disposal of CSNF. The nuclear utilities will soon exceed this waste inventory. Accordingly, CSNF that is discharged from reactors above and beyond the 63,000 MTHM limit does not have a final disposal pathway even with an operational Yucca Mountain unless the legislatively mandated disposal capacity is increased or until another repository becomes available.

Appendices B and C of this report provides an assessment of the potential radiological and non-radiological occupational health impacts of a one-year delay in the initiation of CSNF shipments to Yucca Mountain. Table 5-1 provides a summary of key radiological and non-radiological impacts resulting from a one-year delay in the availability of Yucca Mountain to begin receiving CSNF from reactor sites industry-wide. In addition, if existing ISFSI storage space is consumed or ISFSI storage does not exist, there would be additional occupational risk associated with the construction of a new ISFSI storage pad.

Table 5 - 1
Summary of Industry-Wide Occupational Impacts Due to a One-Year Delay in the Availability of Yucca Mountain (Based on 75 Reactor Sites)

ISFSI Activity	Dose (person-rem)	Injuries and Fatalities (cases)
Surveillance and inspection	9	0.052 TRC 0.027 LWC 4.1×10^{-5} fatalities
Maintenance	112.5	0.052 TRC 0.027 LWC 4.1×10^{-5} fatalities
Additional storage module construction at existing ISFSI	27 – 37	7.5 – 10 TRC 4.2 – 5.7 LWC 0.013 – 0.0189 fatalities

Radiological impacts arise to routine ISFSI operations, totaling approximately 120 person-rem with incremental increases in risk due to non-radiological hazards faced by a utility worker. The construction of additional dry storage modules, as illustrated in Table 5-1 and described in more detail in Appendices B and C, also result in significant increases in worker risk associated with ISFSI expansion.

In the event that either existing ISFSI pad capacity at a particular site is full or does not exist, the construction of a new pad could become necessary. The occupational consequences associated with the construction of one ISFSI pad at a reactor site (from Section C.1.3) is estimated as:

- 22 TRC
- 12 LWC
- 3.9×10^{-4} fatalities

Economic Impacts

In addition to occupational impacts, the further delays of CSNF shipments to Yucca Mountain could also potentially lead to significant costs to the utilities. EPRI expects that between 80% and 100% of CSNF discharged after 2020 will require an equivalent amount of CSNF to be loaded into dry storage. If DOE does not begin repository operations and the subsequent acceptance of CSNF by that time, EPRI assumes that nuclear utilities will have to procure TAD canisters for this additional CSNF that requires on-site storage. Thus, any additional delay in the start of repository operations will result in an economic impact for the nuclear utilities to cover the additional cost of CSNF handling and monitoring, as well as the economic impact associated with the purchase of additional TAD canisters for on-site storage. Appendix *G* provides an assessment of the potential economic impacts of a one-year delay in the initiation of CSNF shipments to Yucca Mountain. These impacts are summarized below:

- Incremental cost of additional TADs to the utilities: $0.75 million per canister, plus $300,000 per storage overpack;
- Cost of additional TAD transfer and monitoring operations at reactor sites: $150,000 to $300,000 per TAD loaded.

Table 5-2 summarizes potential occupational and economic impacts due to a one-year delay in CSNF shipments to Yucca Mountain.

Table 5 - 2
Summary Occupational and Economic Impacts of a One-Year Delay in the Availability of Yucca Mountain

Health or Economic Risk Category	Health Risk Type	Metric of Worker Health or Economic Impact	Lower value	Upper value
Reactor workers	Radiological	[person-rem]	149	159
	Non-radiological	(cases)		
		▪ TRC	30	32
		▪ LWC	16	28
		▪ fatalities	0.013	0.019
Economic [$]	Cost of additional TAD canisters and storage overpacks at reactor sites	Unit Cost per TAD and Overpackg (Millions $)	$1.05	$1.05
	Cost of loading additional TAD canisters at reactor sites	Unit cost per TAD loaded (Millions $)	$0.15	$0.30

6
DRIP SHIELDS ARE NOT NEEDED

6.1 Technical Bases

There are several conservatisms in DOE's analyses of post-closure performance that have led DOE to unnecessarily include drip shields in its repository design. These conservatisms include:

1. Overestimation of the amount of net infiltration, thereby incorrectly indicating a larger benefit of the use of a drip shield than is actually the case;
2. Overestimation of the fraction of the repository experiencing seepage into the open drifts, having the same effect as overestimation of net infiltration;
3. Overestimation of seismic energy and rockfall. This leads DOE to the conclusion that drip shields would provide significant protection from rockfall;
4. Overestimation of damage to the TADs due to seismic and rockfall events. This also leads to the incorrect conclusion that drip shields would be required to provide additional protection from damage of the waste packages;
5. Overestimation of the rate at which Alloy 22 (part of the waste package (WP)) will degrade. This, in turn, gives greater performance credit to the drip shields than is warranted.
6. Cladding performance has been neglected. EPRI analyses indicate that including credit for the performance of the CSNF cladding in the dose analysis is appropriate and that such inclusion would provide an additional barrier to the release of radionuclides from the waste form. This, in turn, would also reduce the need for a drip shield;
7. Performance of the stainless steel barriers (i.e., the inner WP cylinder and the outer shell of the TAD) in the waste package has been neglected. Including performance of these components in the overall performance analysis would also reduce the need for a drip shield.
8. DOE notes that it typically uses the more conservative of two or more conceptual models. Some of these conservatisms could also result in the apparent need for drip shields. As a consequence of this general approach, each conservatism is compounded by conservatisms in other parts of the analysis. Therefore, each of the conservatisms identified here, significant in their own right, compound each other to produce a very large degree of conservatism.

Each of these issues will be discussed in the following subsections

6.1.1 DOE Overestimated Net Infiltration

Both DOE and EPRI have taken the position that there will be three climate states during the next 10,000 years. The definitions of these states are either the same or somewhat similar:

- DOE's "Present-day" and EPRI's "Interglacial" climate states are essentially the same. DOE assumes the "present-day" climate will exist from the time of repository closure to 600 years after closure; EPRI assumes its "interglacial" state will occur from 1000 to 2000 years after repository closure.
- DOE's "Monsoon" climate and EPRI's "Greenhouse" climate states are roughly the same in that both of these climate states assume warmer and wetter conditions in the Yucca Mountain region. DOE assumes the "monsoon" climate will exist from 600 to 2000 years after repository closure; EPRI assumes its "greenhouse" state will occur from the time of repository closure to 1000 years after closure.
- DOE's "Glacial transition" and EPRI's "Full Glacial Maximum" (FGM), while both representative of a cooler, wetter climate than exists today in the Yucca Mountain region, are not exactly the same. While DOE notes that the past coldest glacial states are OIS 16, 12, 6, and 2, which could provide the largest amount of net infiltration and seepage, DOE defines its "glacial-transition" climate to be the transition between OIS 11 and OIS 10. (DOE, 2008b, Section 2.1.2.1.1). As these two climate states are similar, it could be expected that EPRI's choice of the FGM would result in higher amounts of net infiltration and seepage than DOE's "glacial-transition" climate state. Both DOE and EPRI assume the "glacial-transition"/FGM state will occur from 2000 to 10,000 years after repository closure.

A comparison of net infiltration values used by DOE and EPRI is presented in Table 6-1. Since the publication of EPRI's IMARC-8 report (EPRI, 2005a), EPRI numbers in bold italic type have been adopted in its TSPA for all times as sensitivity studies indicate no sensitivity to net infiltration rates during the first 2000 years for the Base Case (no seismic, rockfall, or igneous events), and little sensitivity during the first 2000 years for the Base + Seismic/Rockfall and Base + Igneous Intrusion Cases.

EPRI's best estimate values for net infiltration (EPRI, 2005) are lower than the values used in DOE's license application for all climate states (DOE, 2008b). Hence, EPRI believes that DOE has overestimated net infiltration averaged over the Yucca Mountain repository footprint.

One of the main arguments for the use of drip shields is to reduce the amount of groundwater entering the disposal drifts. As DOE has overestimated net infiltration, this results in an overstatement of the positive effect of the drip shields with respect to long-term repository performance.

Table 6 - 1
Comparison of DOE and EPRI Net Infiltration Rates (mm/y) [Sources: DOE (2008b), Tables 2.3.1-2 through 2.3.1-4 "Repository footprint" values; EPRI, 2005a)]

Climate State	Time Period [years after closure]		Mean-1 s.d./Min (DOE) or Low (EPRI, P=0.05) Value		Mean (DOE) or Moderate (P=0.9) / Probability-weighted (EPRI) Value		Mean+1 s.d./Max (DOE) or High (EPRI, P=0.05) Value	
DOE and EPRI Climate State Name	DOE	EPRI	DOE (Mean - 1 s.d./Min)	EPRI (Low)	DOE Mean	EPRI (Moderate / Prob.-weighted)	DOE (Mean + 1 s.d./Max)	EPRI (High)
"Present Day" (DOE); "Interglacial" (EPRI)	0-600	1000-2000	5.1/1.5	1.1	17.6	7.2/7.0	30.1/48.2	9.6
"Monsoon" (DOE); "Greenhouse" (EPRI)	600-2000	0-1000	9.6/1.2	1.1	32.9	11/11	56.2/95.3	19
"Glacial-Transition" (DOE); "Full Glacial Maximum" (EPRI)	2000-10^6	2000-10^6	17.4/4	***6.8***	38.6	***20***/20	59.8/97.3	***35***

Notes: A direct comparison of values is not possible as EPRI uses a logic tree approach whereas DOE uses a continuous distribution. EPRI assigns a probability of 0.05, 0.9, and 0.05 for the Low, Moderate, and High infiltration rate values, respectively. Hence, the closest comparison would be between DOE's Mean and EPRI's Probability-weighted values. However, the table also compares DOE's "Mean minus 1 standard deviation (s.d.)" and "Minimum" values ("Mean – 1 s.d./Min") to EPRI's "Low" value, and compares DOE's "Mean plus 1 s.d." and "Maximum" values ("Mean + 1 s.d./Max") to EPRI's "High" value.

6.1.2 DOE Overestimated Seepage Rates

Table 6-2 provides a general comparison of the seepage fractions and seepage rates (averaged over all waste packages) for intact drifts (no rockfall) for the three climate states that are postulated by DOE and EPRI. Although difficult to compare directly due to the probabilistic complexity of the DOE seepage model (see the second and third notes under the table for the comparisons EPRI used), EPRI has determined that DOE has significantly overestimated the amount of seepage that would occur into the disposal drifts. Thus, EPRI concludes that DOE's seepage fraction and seepage rate estimates are conservative. Overestimates of seepage fractions and rates will also overstate the potential benefit of using drip shields as one of the purposes of the drip shields is to reduce WP seepage rates.

Table 6 - 2

Comparison of DOE and EPRI Seepage Fractions and Seepage Rates (Maximum Likelihood Flow Field (DOE) Seepage Case (EPRI); Mean (DOE) or Probability-weighted (EPRI) Net Infiltration). [Sources: DOE (2008b); EPRI, 2005a)]

Climate State [DOE/EPRI]	Seepage Fraction (%)		Seepage Rate (kg/yr/WP)*	
	DOE**	EPRI Probability-weighted Seepage Case***	DOE Mean**	EPRI Probability-weighted Seepage Case***
Present-day/Interglacial	1.1	0.33	1.2	0.50
Monsoon/Greenhouse	2.2	0.33	4.6	0.93
Glacial Transition/Full Glacial Maximum (FGM)	4.7	0.44	14.4	1.9

Notes:
*Averaged over all waste packages.
**10th percentile infiltration scenario (maximum likelihood scenario), Section 2.1.2.1.2, (DOE, 2008b)
***Probability-weighed seepage fraction/rate: Base Seepage Case (P=0.96): High Seepage Case (P=0.04)

6.1.3 DOE Overestimated the Amount of Seismic Energy and Rockfall

DOE also indicates that the presence of drip shields will protect the underlying waste packages in the event of rockfall due to thermal stresses or seismic events. The higher the estimate of rockfall, the more beneficial it would seem to install drip shields.

However, EPRI has determined that DOE overestimated the amount of rockfall that will occur for these two mechanisms during the first several hundred thousand years following repository closure (EPRI, 2005b; 2006b). EPRI determined the extent of rockfall (dynamic and static) versus time by dividing the repository into eight rock property categories. In addition to dynamic rockfall during seismic events, long-term stress corrosion cracking of the rock was also considered. Combining the effects of dynamic and static rockfall, along with waste package (WP)-to-WP collisions, over a series of ten seismic events results in only a modest increase in the number of WP failures that occur compared to the nominal scenario (no disruptive events). Thus, adding the multiple seismic event scenario to the nominal scenario increases the probability-weighted peak individual dose by less than a factor of two (EPRI, 2005b). The results from these EPRI analyses are:

- Dynamic rockfall produces inconsequential effects on the waste packages, even for large rock sizes,
- Static effects of rocks on the waste package are inconsequential for credible stresses and maximum extent of potential drift collapse, and
- WP-WP collisions produce damage to the internal lid from impacts with the waste package internals. The outer lid, however, was undamaged by the collisions."

6.1.4 DOE Overestimated the Amount of Damage to TADs due to

Seismic/Rockfall Events

An important clarification regarding the seismic ground motion modeling case is that the releases and annual doses for the 10,000-year time period are only for the damaged co-disposal waste packages. As described in Section 2.4.2.2.2.3 of DOE (2008b), the releases from the commercial SNF waste packages contribute only negligibly to the total dose of the seismic ground motion modeling case because of the low consequences of seismic-induced failures of commercial SNF waste packages. Seismic-induced failures of commercial SNF waste packages result in low consequences largely due to the low probability of damage to TADs bearing commercial SNF in the first 10,000 years. The expected damage frequency for TADs bearing commercial SNF is calculated to be 5.249 × 10-9 per year, which leads to the probability of failure of 5.249 × 10-5 in 10,000 years (DOE, 2008b, pg. 2.4-57). Thus, DOE determines the probability-weighted number of SNF WPs that would fail due to seismic damage during the first 10,000 years is less than one.

The occurrence of seismic events is described as a Poisson process with the highest annual exceedance frequency, max, of potentially damaging events equal to 4.287 × 10-4 per year and the lowest annual exceedance frequency of min equal to 10-8 per year (DOE, 2008a), which is the threshold in proposed 10 CFR 63.342(b) for the occurrence rate of very unlikely events that can be excluded from the performance assessment. Based on these exceedance frequencies from the seismic hazard curve, the expected number of events in any time period T is equal to (max • min)T. Thus, during the first 10,000 years after permanent closure, approximately four potentially damaging events can be expected to occur, compared to approximately 430 potentially damaging events in the 1,000,000-year period after permanent closure (DOE, 2008a).

6.1.4.1 DOE Overestimated Seismic Energy

DOE uses ground motions estimated from its Yucca Mountain Probabilistic Seismic Hazard (PSH) model (Stepp et al. 2001). The seismic hazard curve in Stepp et al. (2001) is reproduced here as Figure 6-1. At return periods of 10^6 years, the Yucca Mountain PSH model predicts a mean PGA and PGV of 3g and 400cm/sec, respectively. These are ground motions that exceed the largest magnitudes ever recorded in the world, so there is some uncertainty as to whether they are physically realistic (Bommer et al. 2004). The PGA curve (presented in Figure 1.7-7 of DOE, 2008b) and reproduced here as Figure 6-1, is an extrapolation of the PSHA curve to 10^{-6}/year and beyond. It is important to recognize that a statistical distribution is just a model of observed data, and extrapolation beyond the range of the data may not be valid. EPRI asserts that the extrapolation of the maximum horizontal acceleration is beyond the region that could be supported by the strength of the rock and soil at Yucca Mountain. In a review of the results of this PSHA, an expert panel convened by the USGS (Hanks, et al., 2006), concluded the following:

> As an overall and quite general finding – and also as a brief summary of the findings that follow – the Committee finds that there are many lines of evidence and argument that can be drawn from a wide range of geological, geophysical, seismological, and material-properties studies that all point to the same general conclusion: at probabilities of exceedance of 10^{-4}/yr and smaller, the seismic hazard at Yucca Mountain as calculated from the 1998 PSHA is too high.

Similarly, a limitation found in the analyses of earthquake ground motion input for Yucca Mountain preclosure surface seismic design and post closure performance (MDL-MGR-GS-000003 Rev 01) states:

> While these ground motions can be used to assess the sensitivity of the response of waste emplacement drifts and engineered barrier system components to such high levels of motions, ultimately results should be evaluated for ground motions that are credible for Yucca Mountain.

This statement reflects the fact that even the authors of the ground motion assessment at Yucca Mountain believe that their results are too high and not credible for design. Their use is only recommended for sensitivity studies. Therefore, it is reasonable to conclude that the consensus in the community of earthquake professionals that ground motion estimates at Yucca Mountain are too high at probabilities of 10^{-6} /year and should be lower.

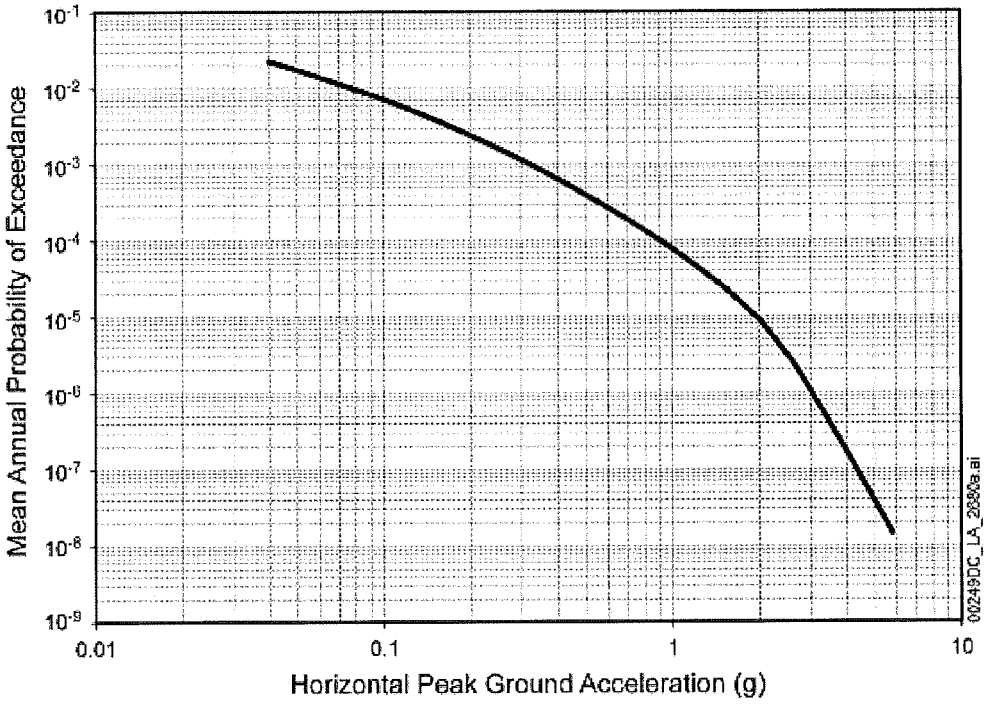


Figure 1.7-7. Seismic Hazard Curve Used in the Preclosure Safety Analysis for Surface Facilities

Figure 6 - 1
DOE Seismic Hazard Curve Adapted for Post-closure Use [reproduced from Stepp et al. (2001), Figure 1.7-7]

Logically, the closest, most active earthquake sources to Yucca Mountain should be responsible for the largest ground motion levels, and EPRI's analysis compared the ground motion levels of these sources to those of the Yucca Mountain PSH model (EPRI, 2006b). Therefore, EPRI considers the Solitario Canyon Fault (SCF) to be the most important fault upon which to base future seismic activity estimates. EPRI also considers one "background fault" in its analyses (EPRI, 2006b).

Figure 6-2 shows EPRI's estimates of the annual frequency of exceedance for PGA and PGV for the SCF and a background earthquake. Each horizontal line of three matching symbols on Figure 6-2 reflects the range of magnitudes estimates for the SCF (EPRI 2006b, Table 2-1). The open circles on the graphs represent the mean PGA and PGV for the 10^6 year return period from the Yucca Mountain PSHA (Stepp et al., 2001). The analysis shows the PGA to be about 0.7 to 1g for the SCF at the 10^{-6}/yr annual frequency of exceedance, (10^6 year return period), considerably less than the 3g estimated from the Yucca Mountain PSH model for the same return period. A PGV of 70 to 160 cm/sec is estimated for the SCF at the same annual frequency of exceedance or return period, considerably less than the 400 cm/sec derived from the Yucca Mountain PSHA. Similar results are obtained for the background earthquake (Figure 6-2).

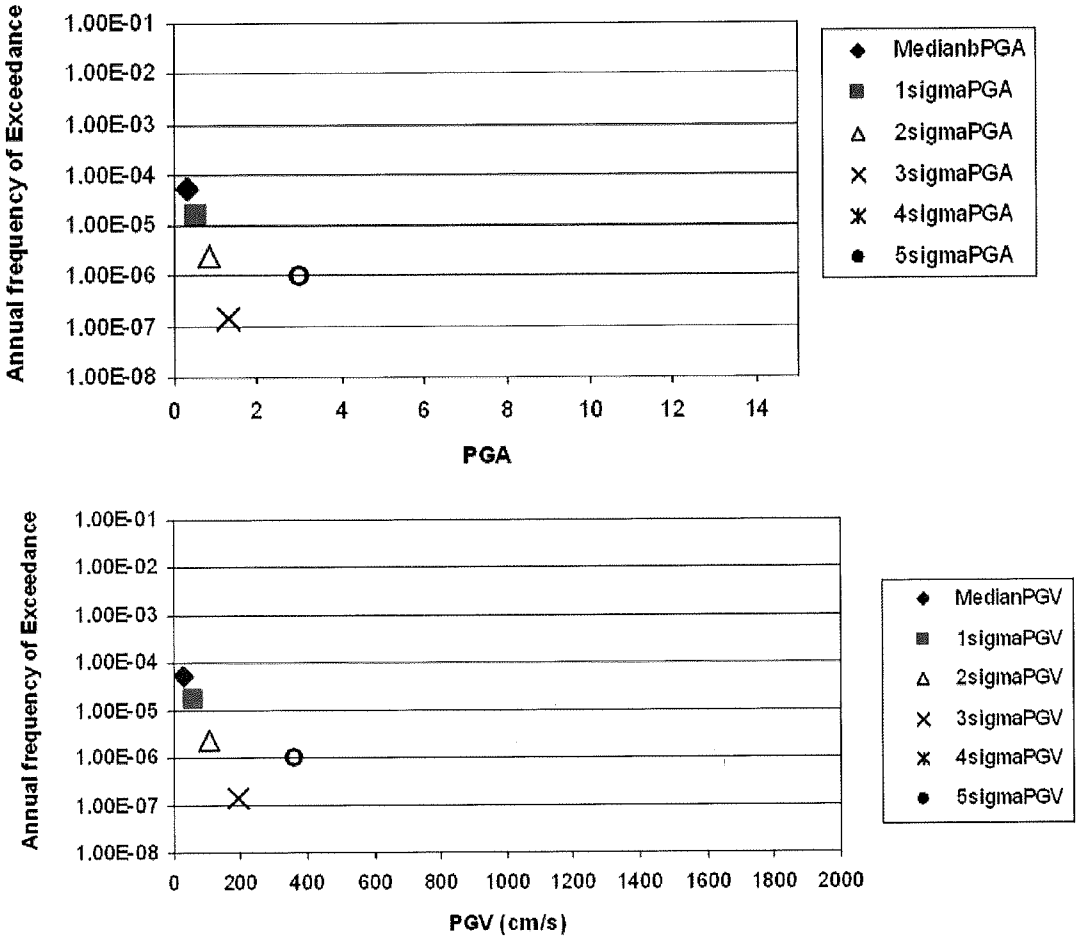


Figure 6 - 2
EPRI's hazard estimates for the Solitario Canyon Fault (upper figure) and background earthquake (lower figure) sources. The open circles show for comparison the mean values for the 10-6/year annual frequency of exceedance (106 year return period) from the Yucca Mountain probabilistic seismic hazard model (Stepp et al. 2001).

Therefore, EPRI has chosen to apply a 0.75 m/s peak ground velocity (PGV) with a 10^5 year recurrence interval, so that repeated seismic events have been stylized as 10 large events over a 10^6 year period, spaced out equally in time (EPRI, 2006b). These large events are those that have

been judged most likely to produce changes in the repository that may alter its long-term performance.

6.1.4.2 DOE Overestimated Waste Package Damage due to Seismicity and Rockfall Events

It is EPRI's position that waste package damage is limited due to seismic and rockfall events for cases involving either the presence or absence of drip shields. EPRI reaches this conclusion even for very large events that occur when the waste package outer barrier is degraded; small events, even if frequent, are expected to produce minimal damage to the waste packages. Smaller events occurring with greater frequency are less likely to be of importance to the Total System Performance Assessment (TSPA).

EPRI (2005b; 2006b) considered the effects on WP integrity for the following cases:

- WP-to-WP collisions due to seismic ground motion with PGVs of either 0.75 m/s or 2 m/s, drip shields in place, either flat-on or oblique WP-to-WP contact;
- Dynamic rockfall directly onto the center of a WP, drip shields absent;
- Static rock rubble loading directly on a WP, drip shields absent, Alloy 22 outer shell either present or absent.

EPRI (2005b) notes however that DOE's own analyses suggest that little rockfall will occur for the first 20,000 years:

> The DOE approach to modeling time-dependent rock degradation in the lithophysal units at Yucca Mountain is judged by EPRI to be reasonable and utilizes the most up-to-date knowledge on time-dependent rock mechanics and numerical techniques. ... DOE's results indicate little rockfall is expected out to 20,000 years after waste emplacement due to time-dependent processes alone. Other [DOE]results ... also indicate that, when combined with thermal loading and seismicity, time-dependent loss of rock cohesion up to 20,000 years is not a major contributor to rockfall. Note, however, that the DOE approach involves basing the UDEC time-dependent model on an exponential formulation of the stress corrosion law without a lower threshold stress limit and use of material properties for heated rather than ambient temperature tuff. These are clearly conservative assumptions, hence, DOE's results ... represent pessimistic upper bounds on possible rockfall for the period of 10,000 to 20,000 years after repository closure.

Therefore the drip shields are not needed to protect the WPs from rockfall for the first 20,000 years following permanent closure or more.

WP-to-WP Collisions

Two sets of impact analyses for adjacent waste packages are discussed in EPRI (2006b): an analysis of a collision into an unyielding surface at 2 m/s and an analysis of a collision into an unyielding surface at 0.75 m/s. Use of an unyielding surface is conservative in that this assumes two adjacent waste packages are traveling in opposite directions, each with a velocity of either 2 or 0.75 m/s.

For 2 m/s PGV, plastic deformation leading to residual stresses does not develop in the WP outer Alloy 22 shell for a flat-on impact between two waste packages (EPRI, 2006b). Some yielding

develops on the inner stainless steel lid and around the connection of the inner lid with the inner stainless steel shell, but this would not affect the performance of the waste package. For an oblique impact where a waste package is tilted at 4 degrees such that the impact is along an edge of the outer lids, some yielding develops in the outer lid under the reduced impact area. Yielding with plastic deformation and residual stresses also develops at the connection of the middle lid to the outer Alloy 22 shell. Such yielding leads to a potential for tearing of the weld at the middle lid connection if the waste package experiences impacts at this PGV multiple times over the life of the waste package. An extrapolation of these results would indicate that the potential for tearing the middle lid connection and yielding in the outer lid should be reduced to a very small probability below an impact of about 1 m/s.

For a PGV of 0.75 m/s, some minor plastic deformation develops on the outer shell in a small area under the concentrated load for the oblique (worst-case) impact orientation. However, no residual damage occurs in the inner or middle lids or in the closure connections for these lids. Thus, it can be concluded that even multiple impacts at this 0.75 m/s impact velocity for the worst-case orientation would not lead to eventual tears or failure of the inner lid as a containment boundary. Although some plastic deformation of the outer shell is predicted for a PGV of 0.75 m/s, this deformation results from compressive loading, so neither immediate structural failure nor delayed SCC penetration is expected. In addition, the extent of damage is so small that even repeated impacts are not expected to lead to a breach in containment.

When the WP inner SS and TAD outer SS shells are intact, DOE reaches a similar conclusion: "Note that for the CSNF WP with intact internals [SCC] damage [due to WP-to-WP collisions] occurs only at the 4.07 m/s PGV level (the probability is zero for all other PGVs" (DOE, 2008b, pg. 6.6-13). For more reasonable PGV values (EPRI, 2005b; 2006b), even DOE finds there will be *no* WP-to-WP damage during seismic events. Hence, both DOE and EPRI conclude the presence or absence of drip shields has no effect on WP damage due to WP-to-WP collisions during seismic events.

DOE also considers a scenario in which the outer containment barrier (OCB, the Alloy 22 shell) could be punctured by sharp WP internals caused by degraded internals. While DOE conservatively concludes that OCB punctures are more likely than SCC failures due to the rubble loading, at more reasonable seismic energy values (PGV less than approximately 1 m/s), even DOE shows essentially no WP damage due to either SCC or internal puncture (DOE, 2008b, Figures 6.6-14 and 6.6-17). Thus, DOE's conservative internal puncture analyses would also inappropriately heighten the value of including drip shields in the repository design.

Dynamic Rockfall

For dynamic loading, EPRI (2005b) conservatively assumed that a large rock block is ejected directly onto the top of a bare WP (i.e., without the DS present), as shown in Figure 6-3. EPRI used an Alloy 22 thickness of 20 mm. The rock block EPRI modeled was assumed to be 7.49 metric tons with a volume of 3.11 m^3. This size of rock is the largest size in a representative grouping considered to have a reasonable probability of occurring for the maximum PGV of 2 m/s that EPRI has determined should be associated with a future seismic event near the Yucca Mountain site. This block was assumed to be ejected with a downward velocity of 2 m/s. Furthermore, EPRI (2005b) conservatively assumed that the rock block struck the unprotected WP on a knife edge (see Figure 6-3). EPRI has concluded that even in the event of the

postulated occurrence, the WP internals would not be degraded in a manner such that they would fail to provide sufficient structural support to protect the contents. EPRI (2005b) concludes that:

> [A] rockfall impact event with the largest size rock in a representative grouping considered to have a reasonable probability of occurring for the maximum PGV of 2 m/s associated with a future seismic event will have very little effect on the longevity of the Alloy 22 WP outer shell. The response of the Alloy 22 material under the impact will likely remain in the linear regime, even with some corrosive thickness reduction, and thus, residual stresses that could accelerate the degradation from stress corrosion cracking will not be present. It seems especially evident that if residual stresses near the yield strength of the material are needed for stress corrosion cracking, then such a rockfall event will most certainly not affect the performance or longevity of the waste package.

Hence, it is EPRI's position that dynamic rockfall directly onto a WP – without the presence of a DS – will not cause any additional damage compared to the case for which a DS was present. Thus, drips shields are not needed to protect a WP from dynamic rockfall.

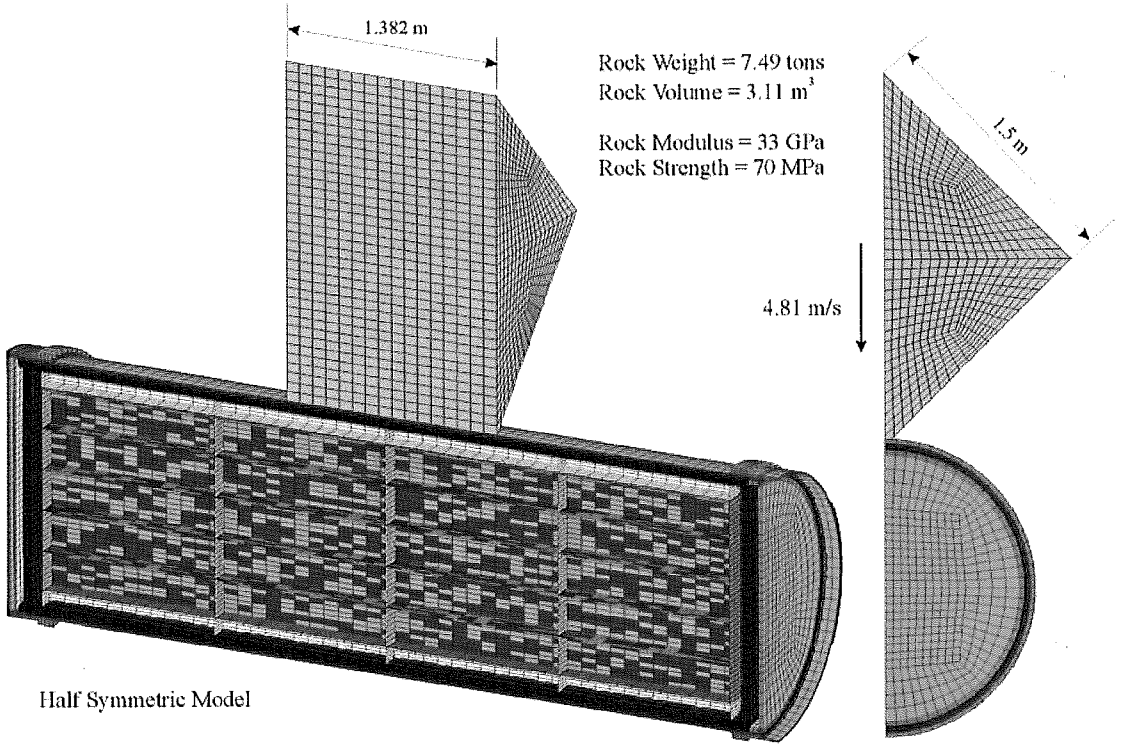


Figure 6 - 3
Finite Element Model and Analysis Setup for Impact due to Rockfall (taken from Figure 12-1 in EPRI (2005))

Analyses were performed to assess the effect of multiple seismic events on the integrity of the engineered barrier system (EBS) (EPRI, 2006b). The analyses are intended to approach a reasonable expectation case, although it is acknowledged that a number of conservatisms remain in the analysis, as a PGV of 0.75 m/s would not be expected to displace the DS. Hence, this analysis does not include the presence of drip shields. Furthermore, it is very conservatively assumed that each large block described above that is ejected leads to the dynamic structural

failure of a single WP. The impact of this conservatism is increased when it is assumed that no drip shields are emplaced.

Static Rock Load

EPRI (2005b) estimates that the maximum bulking height for rubble would be in the range of 5 to 20 meters. EPRI uses this amount of bulking to assess the static load and structural response of the WP.

For EPRI's static rubble analysis (EPRI, 2005b), EPRI considers the structural response of degraded waste packages due to static loads from rubble that would pile up on top of the waste package from a chimney-type collapse of a portion of the emplacement drift. No credit is taken for the drip shield and the Alloy 22 waste package outer barrier (WPOB, the outer Alloy 22 shell). Only the bare stainless steel WP inner shell is considered to be in place as the last structural barrier for protecting the spent fuel.[1] This bounding assumption was made to evaluate whether the structural strength of the inner 316 SS WP shell is sufficient to withstand the maximum credible load of rock resting on the WP. If the rubble static load can be withstood by just the SS inner shell, then it could be concluded that the rubble will not cause early WP failure due to structural failure.

EPRI (2005b) concludes that:

> [A] "bare" WP inner shell can survive the static loads that could develop from a collapse of the emplacement drift at Yucca Mountain for a conservative minimum of a 30-m-high pile of rock rubble. As the bare stainless steel inner shell will remain linear for 30m of rubble, it is extrapolated that a waste package with all or part of the Alloy 22 outer shell present (pristine or partially degraded) will also remain linear for a static load of at least 30m of rubble. The loading from a 30m column of rock conservatively calculated as necessary to mechanically fail a degraded WP far exceeds the loading from a 5-20m column of rock that can possibly be developed in degraded drifts at the Yucca Mountain repository due to rockfall and bulking.

Thus, EPRI's position is that drip shields are also not needed to protect the WP from early structural failure due to the maximum expected rubble height.

This conclusion is echoed by DOE:

> The probability of rupture [structural failure] for the 23-mm-thick OCB with intact internals was determined to be zero. ... Damage for WPs with intact internals was not calculated for WPs surrounded by rubble. A WP becomes surrounded by rubble after DS framework and DS plates have failed during a seismic event. This is expected to occur at late times after repository closure. ... Therefore, CSNF WPs are not likely to have degraded internals at the time of DS failure. (DOE, 2008b, pg. 6.6-14)

However, given that DOE assumes DS failure occurs fairly late in the period of regulatory interest such that some WP corrosion failure may have already occurred, DOE conservatively assumes that groundwater has previously penetrated the WP and degraded the WP internals to

---

[1] This compares to DOE's estimate of the minimum WPOB thickness to be considered for rubble load analyses: "[T]his estimate indicates that the 17-mm-thick OCB provides a reasonable representation for seismic response at the end of the period for assessment of repository performance." (DOE, 2008b, pg. 6.6-12)

the point at which DOE assumes the internals provide no structural support (DOE, 2008b, pg. 6.6-14). Thus, it is not possible to compare EPRI and DOE WP structural failure rates due to the presence of rubble as DOE has conservatively assumed the SS internals to the WP provide no structural support.

Cracking of the WP outer barrier due to the static load of the maximum rubble height could occur if the necessary prerequisites for SCC are met; namely: a tensile stress greater than the threshold stress for SCC, a suitable aqueous environment, and a corrosion potential (E_{CORR}) greater than the threshold value for cracking. In EPRI (2006b), only a fraction of the WPs subject to static loading are consider to fail by SCC. First, only those WPs subjected to a static load from a rock pile >10 m in height are considered to sustain a tensile load greater than the threshold for SCC. This height is a conservative estimate based on the height of the rock pile necessary to induce plastic strain for an unprotected inner stainless steel vessel (40 m for uniform loading of the vessel over a 120° arc), taking into account the stress concentration resulting from point or line loading. This latter effect is simulated using a "stress-concentration factor" of four, based on analyses performed by DOE (BSC, 2004). This estimate conservatively ignores the strength of the Alloy 22 outer barrier itself in determining the necessary height of the rock pile.[2] Second, of those WPs covered by a rock pile >10 m in height, only 71% are assumed to be exposed to an appropriate aqueous environment. Third, only a fraction of the WPs that meet both the threshold stress and environment prerequisites will also exhibit a sufficiently positive E_{CORR} for SCC. EPRI (2006b) concludes that the overall fraction of WP subject to a rock pile >10 m in height that are susceptible to SCC is, therefore, 0.017 (71% of environments multiplied by the 0.024 probability that E_{CORR} exceeds the threshold potential for SCC).

Conclusion of EPRI Seismic and Rockfall Analyses

A total of 64 waste packages are predicted to fail as a result of the repeated seismic events, 18 as a result of dynamic rock impacts and 46, out of a total of 2734 that will be covered by a rock pile greater than ten meters in height, as a result of seismic-induced SCC of the outer barrier (EPRI, 2006b). All of these failures are predicted to occur during the first seven seismic events, with no further drift degradation predicted after 650,000 yrs. The number of dynamic failures decreases with time as the number of large ejected blocks diminishes with each subsequent event. In contrast, the number of static load failures tends to increase with time as more of the drift collapses.

In conclusion, it is EPRI's opinion that a series of conservatisms in DOE's seismic hazard and subsequent rockfall and WP damage analyses has led DOE to believe that drip shields offer some protection to the underlying WPs such that WP failure rates are reduced. EPRI analyses (EPRI, 2005b; 2006b) performed for more reasonable seismic energies and rockfall dynamic and static loads, although still maintaining some conservatism, conclude that excluding drip shields from the repository would have no effect on WP longevity.

6.1.4.3 DOE Finds Drip Shields can Cause WP-to-WP Collision Damage

According to DOE, the presence of drip shields also has the effect of potentially increasing the amount of WP damage due to seismic events. DOE analyses indicate that if the drip shield is present during a significant seismic event, then some WPs will be damaged due to WP-to-WP

[2] Corrosion resistance of the Alloy 22 is not ignored, however.

collisions (DOE, 2008b) Section 6.6 of DOE(2008a) discusses DOE's approach to estimating DS and WP damage due to seismic events. The seismic events considered in the TSPA-LA (DOE, 2008a) are

> Dynamic loads on WPs free to move during a seismic event have the potential to result in a rupture (tear) of a WP if the local strain exceeds the ultimate tensile strain. Dynamic loading from a single impact may not produce tensile strains in the Alloy 22 outer corrosion barrier (OCB) that exceed the ultimate tensile strain. However, the extreme deformation from a major seismic event could weaken the OCB, potentially resulting in a ruptured OCB from a subsequent extreme seismic event. ...
>
> The probability of rupture for WPs with degraded internals surrounded by rubble is zero because the strain on the OCB is always below the ultimate tensile strain for Alloy 22. ... However, a severely deformed OCB may be punctured by the sharp edges of fractured or partly degraded internal components. The WP internals are assumed to degrade as structural elements after the OCB is first breached.

In contrast, EPRI (2006b) finds that for a reasonable maximum PGV values, no WP-to-WP collision damage is expected to occur.

Therefore, EPRI concludes that DOE has significantly overestimated the PGV and PGA that would occur during reasonable maximum seismic events. This leads to an overestimate of rockfall such that the value of the drip shields in preventing WP damage due to rockfall has been overstated. However, even if significant seismic activity and, hence, rockfall occurs directly onto an unprotected WP, it is EPRI's position that, at most, only a handful of WPs will fail earlier than if drip shields are used.

6.1.5 DOE Overestimated the Likelihood and Rate at which Alloy 22 could Degrade due to Localized Corrosion

It is EPRI's position that DOE has overestimated both the localized corrosion initiation conditions and penetration rate for Alloy 22. Overestimates of these conditions and rates would artificially accentuate the importance of the presence of drip shields.

As described below, DOE conservatively applied a crevice initiation model in two different ways. Crevice initiation was assumed to occur anywhere on the WP surface, even though DOE recognizes crevice initiation will be much more localized:

> Crevices may form on the waste package surface at occluded regions, such as in between the waste package and the emplacement pallet Alloy 22 surfaces and potentially beneath mineral scales, corrosion products, and rocks. It is not expected that the entire waste package surface will be subjected to crevice-like conditions; therefore, application of the crevice repassivation potential model as a criterion for the initiation of localized corrosion to the area subjected to seepage, is conservative. (DOE, 2008b, Section 2.3.6.4.3.1.3)

Furthermore, DOE conservatively assumed there is no critical temperature below which no localized corrosion would occur:

> ... The modeling approach did not incorporate a critical temperature below which no localized corrosion would occur, regardless of other conditions in the bulk chemical

> exposure environment. In fact, the empirical rules used to implement the corrosion initiation model (Section 2.3.6.4.4.1) include evaluation of corrosion initiation down to exposure temperatures as low as 20°C. (DOE, 2008b, Section 2.3.6.4.3.1.3)

EPRI (2007b, Section 5.9.5) finds that crevice initiation is highly unlikely – even under aggressive chemical conditions: "...it is unlikely that multiple-salt deliquescent brines could form on WP surfaces in drifts at Yucca Mountain, and, if such brines were to form and be stable for some reason, that they would be incapable of initiating and sustaining localized corrosion of the Alloy 22 outer boundary." Only a small fraction of the possible water chemistries could potentially support localized corrosion. This water accounts for only 1% of all of the possible waters at YM so that, on average, localized corrosion is only possible in 1 out of every 100 realizations in EPRI's WP degradation model (EBSCOM). Initiation in EBSCOM is treated using a threshold temperature for localized corrosion.

Thus, EPRI's opinion is that DOE's assumption that crevice corrosion can occur over the entire WP surface is conservative.

Once crevice corrosion is initiated, DOE then applied a conservative localized corrosion penetration rate. DOE assumes a constant penetration rate with time and also applies a rate for aggressive chemical conditions:

> ... a range of potential localized corrosion rates is determined for two highly aggressive environments: (1) 10 wt % $FeCl_3$ test solution (12.7 μm/yr) ... and (2) concentrated HCl solutions at elevated temperatures (where passive film is degraded), with corrosion rates between 127 and 1,270 μm/yr. ... *The use of an Alloy 22 corrosion rate of 12.7 μm/yr measured in a $FeCl_3$ solution containing about 2.1 m chloride ions at 75°C is a suitable analogue crevice solution for estimating the lower bound for metal dissolution* ... because this represents a transpassive corrosion condition. [emphasis added, From DOE, 2008b, Section 2.3.6.4.2.3]

In contrast, EPRI analysis finds that pits will stifle, i.e., crevice corrosion rates will drop to *zero* before the crevice has penetrated the Alloy 22 (EPRI 2004).

Furthermore, DOE implies that crevice corrosion will have only a minor effect on mean dose rates even if the drip shields fail early:

> ... although the Alloy 22 localized corrosion abstraction ... is part of the TSPA model, there are no modeling cases in which the detailed results of the localized corrosion abstraction result in a dose consequence. ... The only modeling case impacted by localized corrosion is the drip shield early failure modeling case, where it is assumed that the waste packages underneath the failed drip shields are failed by localized corrosion. ... *Because the occurrence rate is so low for early drip shield failures, this assumption is conservative, but only slightly.* [emphasis added, From DOE, 2008b, Section 2.4.2.3.2.1.2]

Thus, EPRI concludes that DOE has overestimated both the potential for crevice initiation and the localized corrosion rate. Given DOE's overestimations, the longevity of the WPs has been underestimated. This underestimation results in an inappropriately high relative importance of the drip shields to delay onset of localized corrosion.

6.1.6 DOE Neglected Cladding and Inner Stainless Steel Waste Package

Performance

DOE has conservatively assumed that the CSNF cladding will not provide any sort of barrier to the delay or release rate of radionuclides from the UO2 waste form [DOE 2008b, Section 2.4.2.3.2.3.2.3]. Neither has DOE taken credit for the performance of the inner stainless steel canisters within the waste packages or the outer stainless steel shell of the TAD. Without taking any credit for the performance of cladding or the inner stainless steel barriers, the performance of drip shields would seem to be more important than it really is.

EPRI does find that there is sufficient basis for taking credit for the performance of the CSNF cladding in its TSPA model (EPRI, 2000). Available data on the corrosion of zircaloy CSNF cladding were evaluated to derive an estimated cumulative failure curve as a function of time (Figure 6-4). It was assumed that approximately 2% of the cladding was failed prior to emplacement in a repository. After eventual failure of the waste package/EBS, two corrosion modes for the cladding were considered: (1) general corrosion under dry (moist air) conditions, and (2) general corrosion under dripping conditions. At 10,000 years after EBS failure, about 20% of cladding was projected to have failed under dripping conditions and no additional cladding failures were predicted to occur under dry conditions (EPRI, 2000).

Therefore, EPRI concludes that DOE's failure to take credit for the performance of the cladding is overly conservative. Failure to take credit for this additional, available engineered barrier to function as both a barrier and a delay mechanism results in an artificial increase in the relative importance of drip shields.

While it is certain that the stainless steel shells in the waste packages will provide some delay of radionuclide release and reduction of release rates, neither DOE nor EPRI have attempted to quantify this performance. Taking credit for this performance would also diminish the relative importance of the drip shields.

6.1.7 General DOE use of the More Conservative of Available Models

DOE also notes that in general, it uses the more conservative of multiple models that provide a reasonable representation of available data. Several of these conservatisms have caused DOE to underestimate the performance of the EBS components other than the drip shields. These several conservatisms, taken together, represent a significant compounding of each individual conservatism. Because the performance of an entire series of EBS components has been underestimated, together these underestimates have caused DOE to conclude that the addition of drip shields is a necessary component of the EBS.

EPRI disagrees that the drip shields are a necessary component of the EBS. EPRI analyses assuming no drip shields, shown in Figure 6-4b, indicate that the dose rates to the RMEI out to 1,000,000 years after repository closure is still significantly less than the proposed EPA dose limits.

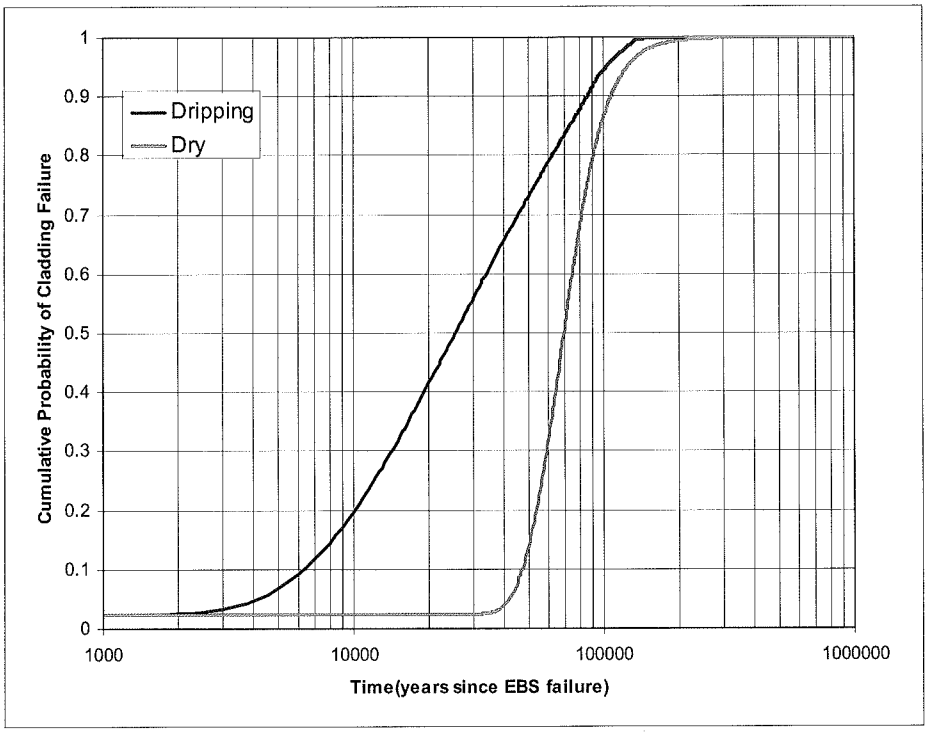


Figure 6 - 4
Derived Cumulative Failure Curves for Zircaloy Cladding (EPRI, 2000)

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6.1.8 Peak Dose Sensitivity with and without Drip Shields

EPRI performed a TSPA analysis using its IMARC code to compare EPRI's Base Case (drip shields present) and a sensitivity study for which EPRI assumed the drip shields were not present. Figure 6-5 shows the IMARC results for the Base Case (Figure 6-5a) and that for no drip shields (Figure 6-5b). There is a moderate increase in doses at early times associated with the waste package that is assumed to be initially failed owing to manufacturing defects. It is noteworthy that even in the EPRI analyses, the assumption of one initially failed waste package is a conservatism as the expected value of waste package failures from manufacturing defects is

significantly below one. The change in peak dose without the presence of the drip shields is negligible, and is still well below the limits established in the proposed EPA/NRC standards.

Based on all the considerations in Section 6.1, EPRI concludes that drip shields are unnecessary.

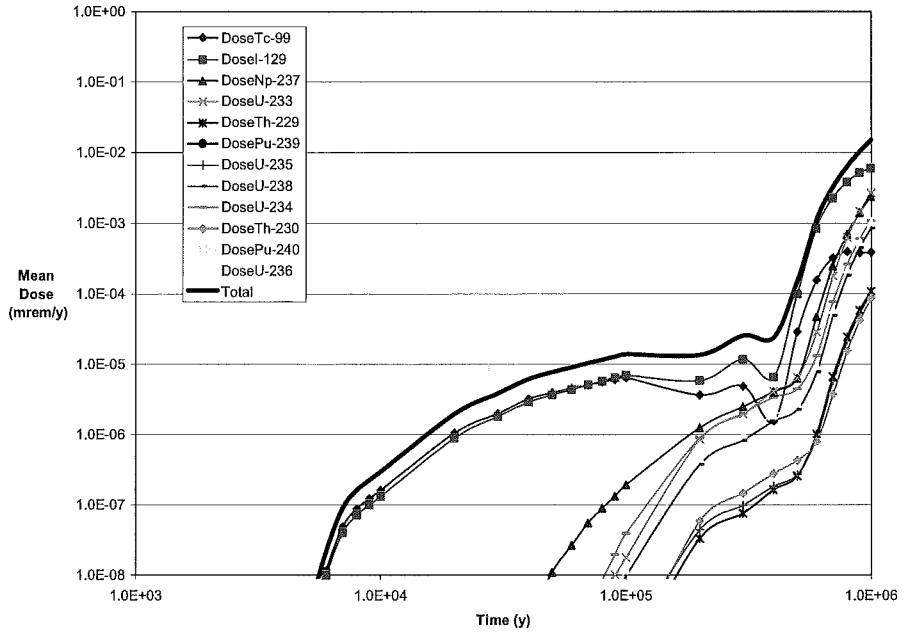
6.2 Impacts of Drip Shield Installation

The YMSEIS (DOE, 2008d) assumes that the annual individual dose associated with installation of the drip shields is 9.75 mrem per year, with a staffing of 10 persons per year, resulting in a total dose of 97.5 person-mrem per year. The repository closure phase is assumed to last for 10 years, although it is not clear from the YMSEIS whether the drip shield installation operations will take place during the entire 10-year operations-closure phase. If drip shield installation takes five years, the total dose would be 487.5 person-mrem. If it takes ten years, the total dose for drip shield installation would be 975 person-mrem. (BSC, 2007)

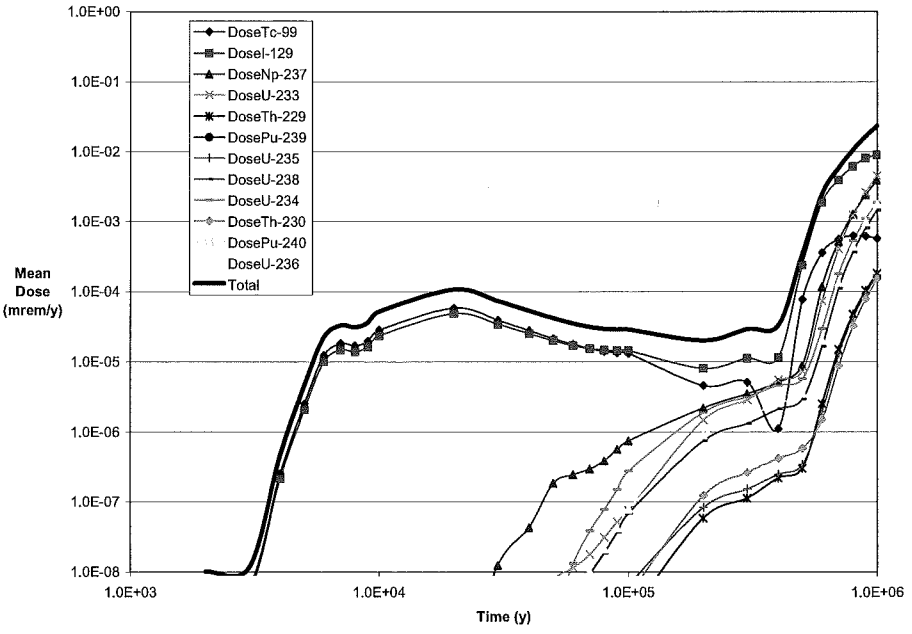
Non-radiological impacts are estimated in a similar fashion. For a five-year period for drip shield installation, the resulting estimates for worker impacts are 4.1 TRC, 2.7 LWC, and 0.009 fatalities. For drip shield installation over the entire ten-year closure period, the estimated non-radiological worker impacts would be 8.2 TRC, 5.4 LWC, and 0.018 fatalities.

Table 6 - 3
Summary of Worker Impacts Associated with Drip Shield Installation

Assumed Duration of Drip Shield Installation (years)	Total Worker Dose (person-mrem)	Non-Radiological Impacts (Cases)
5	487.5	4.1 TRC 2.7 LWC 0.009 fatalities
10	975	8.2 TRC 5.4 LWC 0.018 fatalities



(a)



(b)

Figure 6 - 5
Comparison of EPRI's Base Case (a) and No Drip Shield (b) TSPA Results

By advocating the use of drip shields, DOE is creating substantial resource demands for titanium (Ti), a material of significant strategic importance and of limited domestic availability.[3] DOE estimates that its projected schedule for drip shield manufacture will result in consumption of 22% of present day annual U.S. production of Ti for a limited period of time. Moreover, manufacture of the drip shields incurs occupational risks to involved workers. The YMSEIS estimates that 11,500 drip shields will be used under the Proposed Action. And as a heavy component, the YMSEIS also assumes that 25 drip shields will be shipped per rail car, with a total of 460 shipments. The YMSEIS assumed a shipping distance of 3,464 km, resulting in potential pollution health effect fatalities of 0.028 and vehicle fatalities of 0.036 – or total fatalities of 0.064 associated with the transport of drip shields from manufacturing facilities to the proposed repository (DOE 2008b, Transportation File, Attachment 12, Other materials).

In addition to the fatalities associated with transport of the drip shields, offsite manufacturing of 11,500 drip shields is estimated to require 3.5 million labor hours. The YMSEIS analysis of off-site manufacturing health and safety impacts assumed 9.1 injuries per 100 full-time worker years and 3.29 fatalities per 100,000 worker years. This results in 159 injuries and 0.609 fatalities associated with off-site manufacturing of the drip shields. (DOE 2008b, Offsite Manufacturing File, Attachment A.) These injuries or fatalities could be avoided if there was no need for the manufacture of Drip Shields for placement within the repository.

[3] Although not studied in this report, the resource demand for palladium may also be substantial.

7

DOE HAS OVERDESIGNED PRE-CLOSURE SURFACE FACILITY STRUCTURES FOR SEISMIC RISK AND EFFECT MITIGATION

7.1 Technical Bases

7.1.1 Design of Pre-closure Surface Important to Safety (ITS) Facility Walls is Very Conservative

The facility descriptions in Section 1.2 of the Licensing Application (LA, DOE (2008a)) indicate that the ITS portions of the four main processing structures, the Receipt Facility, Initial Handling Facility, Canister Receipt and Closure Facility, and the Wet Handling Facility (RF, IHF, CRCF and WHF, respectively) are all designed primarily with 4-ft thick external and internal walls. The total length of the walls that will be constructed cannot be currently estimated, as the floor plans for these buildings have been classified "For Official Use Only" (FOUO). However, walls of this thickness require special construction procedures to account for the heat generated during the concrete curing process. In addition, the large volume of the reinforcing bar and concrete required will increase the risk of accidents during construction.

The design basis for the 4-ft thickness appears to be due to seismic loads. Neither radiological safety of protection from aircraft crashes should be the controlling factor for the wall thickness. Per Section 1.6.3.4.1 of DOE (2008b), event sequences due aircraft impact has been screened out, citing "the probability of an aircraft crash is 3×10^{-5} over the preclosure period, which is less than the screening threshold of 10^{-4}. In addition, a procedural safety control on control of aircraft over-flights will be implemented..." It be noted that the fuel will be in shielding casks except during transfer operations. Therefore, the safety benefit of the walls against aircraft crashes is insignificant.

If the design is driven by the need for shielding following accidents, these walls will provide a gamma attenuation in excess of 10^{6}. This compares to roughly 3-ft concrete thicknesses used in concrete dry storage casks for shielding purposes.

The subsections below examine the design and robustness of the walls against seismic events. The paragraph below summarizes EPRI's opinion based on our review of available documents.

Based on a review of the seismic criteria document in BSC (2007b) and the results documented for the CRCF in BSC (2008), EPRI finds that the HCLPF capacities (High Confidence of Low Probability of Failure) calculated for the ITS structures indicate that these structures are over designed, and wall thicknesses can be reduced while maintaining the required safety levels against seismic failure. The required HCLPF capacity is recommended to be 10% higher than the demand imposed by the 10,000 year return period earthquake or 1.1x0.91g=1.0g (BSC, 2007b, page 48). The HCLPF capacities are to be calculated using the energy dissipation factor of 2.0 corresponding to Limit state A (imminent collapse) given in ASCE/SEI 43-05. BSC (2008), Table 6.2-1, indicates the HCLPF capacity of the CRCF is 1.82g). The 1.82g capacity

reported is based on an energy dissipation factor of 1.75, and therefore the capacity corresponding to Limit state A is actually (2.0/1.75)x1.82g=2.1g. This is twice the required capacity of 1.0g, which suggests the thickness of the walls can be reduced while maintaining sufficient seismic margin to easily meet the design requirements. The DOE seismic assessment appears to have recognized this. Recommended refinements in fragility calculations are provided in section B.6 of BSC (2008), but have not been implemented by DOE.

7.1.2 Seismic Design Evaluation

The DOE seismic design basis for surface ITS structures are provided in Table 7-1.

The seismic basis for DBGM-2 (Design Basis Ground Motion -2) are::

- Events with a mean annual probability of exceedance (MAPE) of 5 x 10^{-4} (2,000-year return period), designated as Category 2 events. (0.45g, as shown on Figure 7-1)
- BDBGM (Beyond Design Basis Ground Motion) are events with a MAPE of 10^{-4} (10,000-year return period). (0.91g, as shown on Figure 7-1)

Table 7 - 1
DOE Seismic Bases for Analysis and Design [taken from BSC (2007b), page 11]

Location	SSCs	Seismic Basis[a] for Analysis/Design
Surface	Aging Pads	DBGM-2
	Canister Receipt and Closure Facility	DBGM-2
	Emergency Diesel Generator Facility	DBGM-2[b]
	Initial Handling Facility	DBGM-2
	Receipt Facility	DBGM-2
	Wet Handling Facility	DBGM-2

Figure 7-1 (BSC, 2007a, p. 75) shows the horizontal seismic hazard curve that DOE is using for the YMP. The figure shows the values of horizontal peak ground acceleration (PGA) at 100 Hz applicable to the design of the surface facilities. The critical evaluation for safety purposes is the Beyond Design Basis Ground Motion (BDBGM) event, which is 0.91g for the return period of 10,000 years.

The DOE structure fragilities are provided in Table 7-2, which reproduces Table 6.2.-1 of BSC [2007b] This table shows that the example citing the CRCF used above does not reflect the most robust facility. Both the IHF and the RF can survive a more severe seismic event than the CRCF. It should be noted that the LLW is designed to other criteria, as it will not have contact with CSNF.

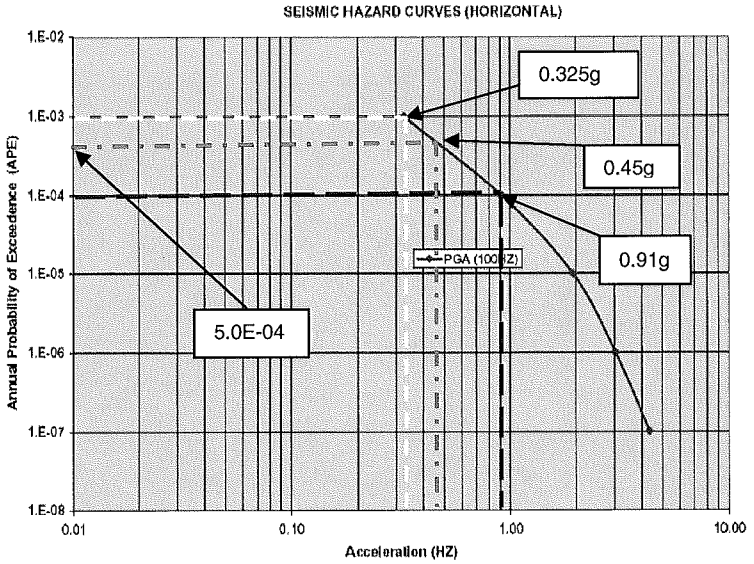


Figure 7 - 1
DOE Horizontal Seismic Hazard Curve [adapted from DOE 2008b, Figure 1.1-89]

Table 7 - 2
DOE Structure Fragilities [BSC, 2007b, Table 6.2-1]

Table 6.2-1. Fragilities for Structures

Structure	Am	βc	HCLPF	Frequency of Failure (/yr)	Basis / Reference
IHF	5.35	0.4	2.11	3.8E-07	Ref. 2.2.33 and Ref. 2.2.32
RF	5.25	0.4	2.07	4.1E-07	Ref. 2.2.72
CRCF	4.61	0.4	1.82	7.8E-07	Ref. 2.2.26
WHF	4.51	0.4	1.78	8.7E-07	Ref. 2.2.54
WHF pool	4.51	0.4	1.78	8.7E-07	Same as WHF building
Aging pad (shear and bending)	2.46	0.4	0.97	9.8E-06	Ref. 2.2.75
Horizontal aging module	4.5	0.4	1.77	8.8E-07	Based on other ITS structures above
LLW Facility	0.89	0.4	0. 35	1.6E-04	IBC, SUG III design (Ref. 2.2.47)

NOTE: CRCF = Canister Receipt and Closure Facility; HCLPF = high confidence of low probability of failure; IHF = Initial Handling Facility; ITS = important to safety; LLW = Low-Level (radioactive) Waste; RF = Receipt Facility; WHF = Wet Handling Facility.

7.2 Impacts of Seismic Over-design

The avoidable occupational health impacts of DOE's ITS surface structure design for seismic risk mitigation are caused by unnecessary construction material production and transportation, and unnecessary on-site construction activities. Appendix C provides a general description of

construction-related occupational health impacts per unit time per Full-time Equivalent (FTE) worker. It is difficult to identify what fraction of the total construction health impacts summarized from the YMSEIS in Table C-5 could be avoided if the ITS structures had not been over-designed for seismic risk mitigation. However, since this table indicates that the highest worker risk is during the construction phase (rather than during the operations or closure phases), the avoidable construction risk may be significant.

Specific facility design information is omitted from the publicly available version of the License Application as a result of its designation as "Official Use Only" information. In the absence of this level of detail, EPRI attempted to evaluate the occupational consequences on a more generic, semi-quantitative level using a stylized approach based on the available dimensions for the WHF footprint, typical above-grade height, and wall thickness. EPRI assumed for the purpose of this illustration a WHF facility comprised solely of a rectangular concrete shell (an extremely conservative assumption that neglects interior walls, and contributions from the roof and foundation components). As part of this approach, EPRI ignored the contributions from roof, base mat/pad, and interior walls. The data, assumptions, calculations are described in Section C.3.6.

For a representative structure derived from the description provided in the LA for the WHF, the concrete volume of 438,400 ft^3 was calculated for the 4-foot thick exterior walls occupying an ITS footprint of 385 ft. x 300 ft. For a ready mixed concrete truck capacity of 240 ft^3, this corresponds to a total of 812 truck loads.

Accordingly, for illustration purposes, any unjustified margin resulting from overly conservative treatment of seismic hazards will be reflected in additional use of construction materials and FTEs and the additional burden of occupational risk to workers. For example,

A 10% over-design margin corresponds to 43840 ft^3 or 81 concrete truck loads.

A 25% over-design margin corresponds to 109600 ft^3 or 203 truck loads.

Clearly, any unnecessary and unjustified conservatism in the construction of WHF and other surface pre-closure facilities will result in incremental increases in worker risk due to well-documented occupational hazards. In addition to the often repeated fact that the construction industry is a perennial leader in occupational injury and fatality rates, the Bureau of Labor Statistics has also singled out three specific occupations that exhibited exceptionally high fatality rates in 2005: structural iron and steel workers, truck drivers, and construction laborers.

In lieu of specific occupational risk estimates for the WHF construction, fatality rate data from Table C-9 and injury/fatality rate data from Table C-10 are presented below (Tables 7-3 and 7-4).

The reinforcement of concrete structures to withstand seismic loads directly involves all three of these high-risk occupations for the preparation of appropriate concrete forms, assembly of additional rebar, and pouring of additional concrete. Additional concrete also results in additional truck deliveries that could number in the 100's to 1000's for the case of an over-designed facility. Accordingly, the purposeful over-design (beyond standard engineering margins) for seismic or any other hazard represents unnecessary and unjustified imposition of risk to the involved workers.

Table 7 - 3
Selected occupations with high fatality rates for 2005 (BLS, 2006a)

	Fatalities (per 100,000)
Structural iron and steel workers	55.6
Driver/sales workers and truck drivers	29.1
Construction laborers	22.7

Table 7 - 4
Relevant BLS[a] and DOE[b] Non-radiological Injury and Fatality Rates

Category	TRC	LWC	Fatalities
BLS - construction	6.3	3.4	11.0
BLS - warehousing and storage	8.2	5.4	17.6[c]
BLS - truck transportation	6.1	3.9	17.6[c]
DOE - construction period[b]	2.0	0.86	0.55

[a]BLS, 2006a,b
[b]DOE 2008d, Table 4-16, Section 4.1.7.1
[c]Fatalities for transportation and warehousing category, NAICS code 48-49

It should be noted that DOE's injury and fatality rates are substantially lower that reported by BLS. DOE does not differentiate between specific trades and occupations such as iron workers.

In addition to occupational consequences, the over-design of facilities also consumes significant quantities of materials and resources that would have beneficial uses elsewhere, especially in terms of concrete (cement and aggregate) and rebar (iron/steel).

8
DOE HAS OVERESTIMATED POST-CLOSURE SEISMIC RISK AND EFFECTS

8.1 DOE Overestimated Post-closure Seismic Risk and Effects

As discussed in Section 7.1.4 above, EPRI has determined that DOE has overestimated both the post-closure seismic risk and the effects on repository performance due to seismic activity.

As shown in Figure 8-1, DOE's overestimate of post-closure seismic risk and repository performance effects has caused DOE to find that a major contributor to peak RMEI dose is due to seismic ground motion. While it is not possible to estimate the results DOE would have produced if it had used more reasonable seismic risk and repository performance effects assumptions, it is likely the dose rate estimate for this scenario would be lower, perhaps considerably so. If the igneous intrusion and eruptions scenarios had been eliminated from consideration, as EPRI states is appropriate in Section 5 of this report, and more reasonable estimates of seismic risk and repository performance were used, it is quite possible that the resulting total dose estimates DOE would have derived would be as much as two orders of magnitude lower. If so, this would cause DOE's peak dose results to be fairly similar to the results calculated by EPRI (shown in Figure 8-2).

8.2 Impacts of Post-closure Seismic Risk and Effects

It is unclear what effect DOE's overestimate of post-closure seismic risk and repository performance effects may have on occupational health and safety risk. For example, the DOE overestimates likely have caused DOE to make the TADs more robust than necessary, thereby adding manufacturing complexity. If so, then the additional manufacturing complexity itself may cause an increase in occupational health and safety risk. Furthermore, if the TAD manufacturing process takes longer than a more reasonably designed TAD for more realistic post-closure seismic risk, there could be a delay in moving CSNF from reactor sites to Yucca Mountain.

The occupational health impact due to a one-year delay in the opening of the Yucca Mountain repository has been described in Appendix B and C, and summarized in Table 5-2 of this report.

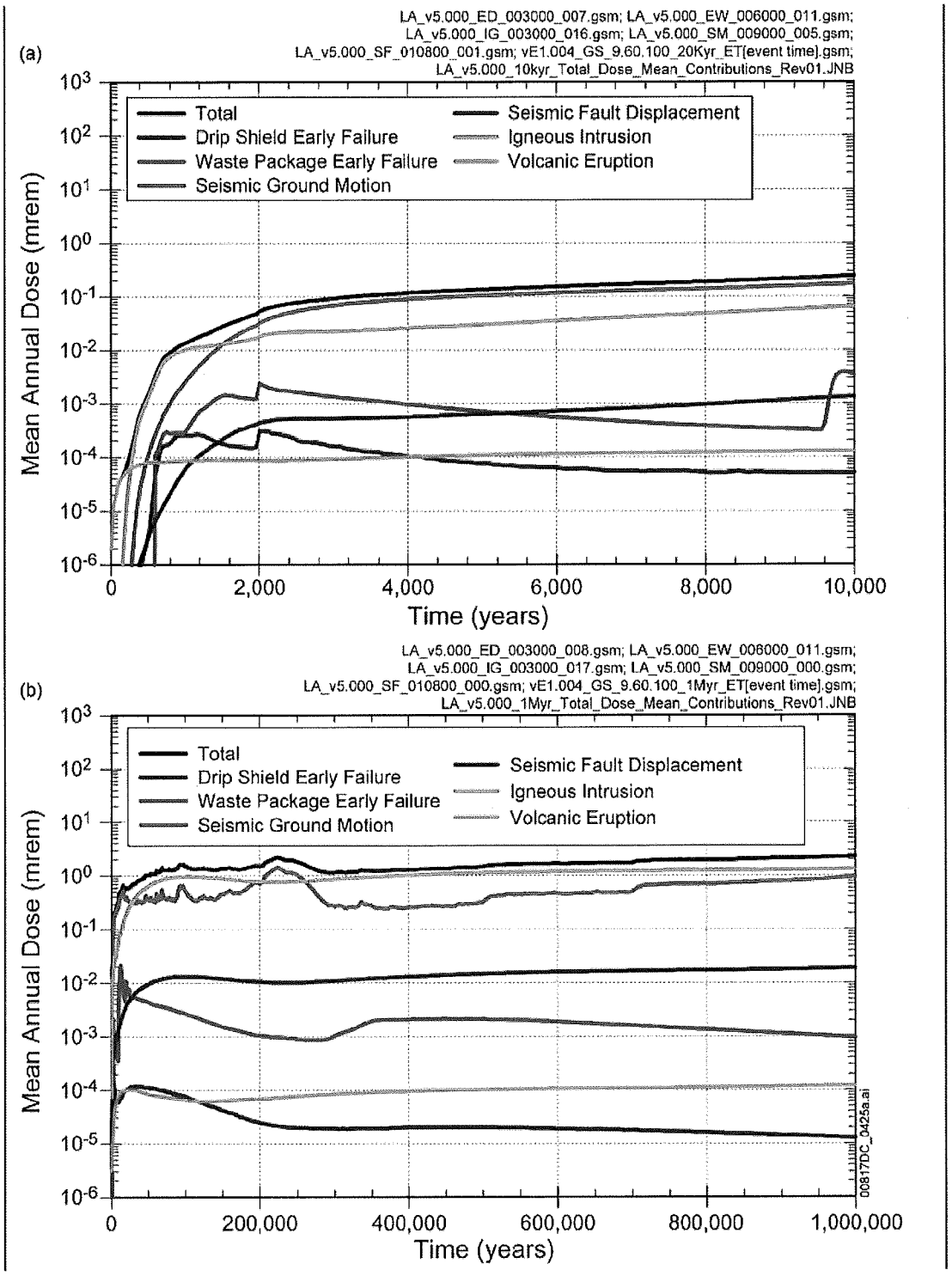


Figure 8 - 1
DOE estimates of RMEI mean annual dose for the 0 to 10,000- (upper figure) and 0 to 1,000,000-year (lower curve) time frames (taken from Figure ES-58 in DOE, 2008b).

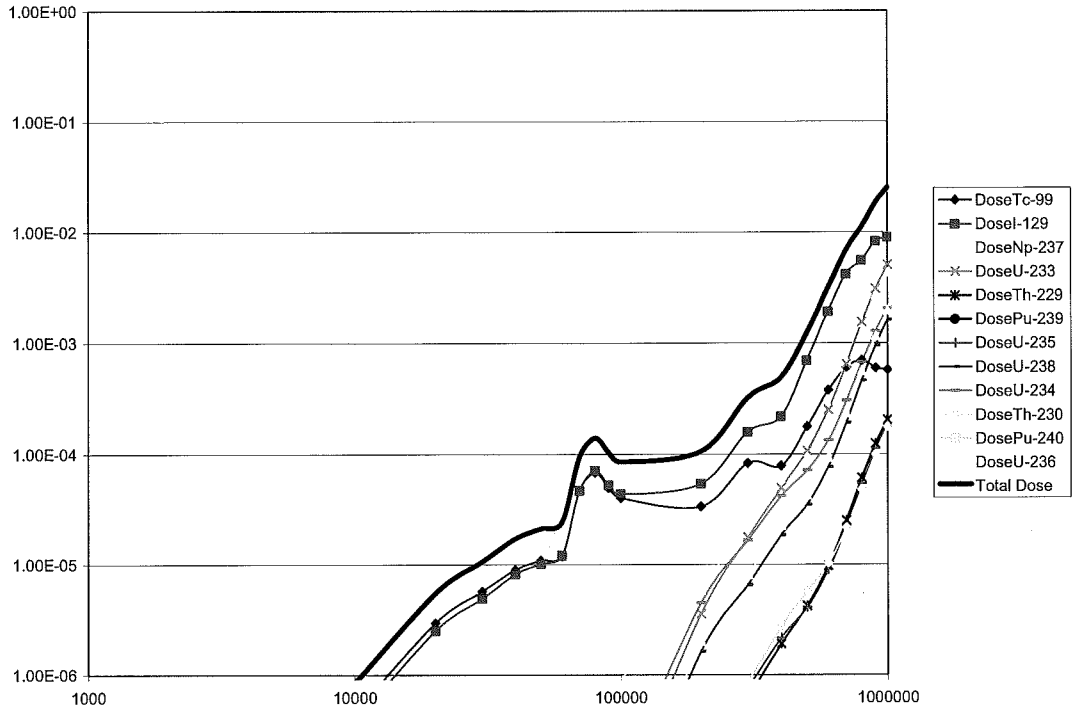


Figure 8 - 2
EPRI CSNF waste package dose results for the Base Case + Seismic Scenarios. Axis units: x: years after repository closure; y: RMEI annual dose rate (mrem).

9

DOE'S APPROACH TO WASTE PACKAGE DESIGN FOR TADS AND CO-DISPOSAL WASTE PACKAGES MAY RESULT IN LICENSING DELAY

With the introduction of the TAD concept for transportation, aging, and disposal of CSNF, DOE has made the TADs more robust than the defense co-disposal waste packages. The Alloy 22 outer shell of the TAD is 25mm while the Alloy 22 shell for the co-disposal waste packages remains at 20mm. Furthermore, the double stainless steel inner canisters in the TADs provides more structural integrity. Thus, DOE concludes: "The CSNF WP is demonstrably more robust [than the co-disposal WP] based on a comparison of the probabilities of damage to WPs with intact internals." (DOE, 2008b, pg. 6.6-7)

DOE notes that the first peak in its RMEI dose estimate, shown in the lower figure in Figure 8-1, is primarily due to failure of the defense co-disposal waste packages. This peak rivals that of the ~1,000,000-year peak caused primarily by the TADs containing CSNF. While EPRI finds significant conservatisms in DOE's TSPA analyses for both the co-disposal and TAD waste packages, DOE's performance assessment results may cause an unnecessary amount of regulatory scrutiny to be placed on the co-disposal waste package behavior. If so, then the repository licensing process may take longer to complete, thereby resulting in a potential delay in the opening of the repository.

The occupational health impact due to a one-year delay in the opening of the Yucca Mountain repository has been described in Appendix B and C, and summarized in Table 5-2 of this report.

10
DOE'S PROPOSED REPOSITORY DESIGN CALLS FOR UNNECESSARILY LARGE SPACING OF DISPOSAL DRIFTS

10.1 Technical Bases

The current repository design uses closely-spaced waste packages (10-cm spacing between each nuclear waste package) in each disposal drift, but with an 81-meter pitch between emplacement drifts. The fundamental rationales of this design include:

- Close spacing within each drift (10 cm) causes each drift to simulate a 'line-load' of radiogenic heating with intense but uniform heating along the entire length of each emplacement drift,
- Radiogenic heating causes localized boiling and removal of water within the emplacement drift and to a limited extent within the surrounding tuff, and
- Extended spacing between drifts (81 meters) and limited extent of boiling around drifts assures that a sub-boiling pillar of tuff rock persists for all time between the neighboring emplacement drifts to allow continuous drainage of any condensate water that may collect above the repository.

This extremely large 81-m pitch is a conservative design, which is relatively space-inefficient compared to other designs that are within rock-mechanical constraints determined by the need for mechanical stability of the drifts (EPRI 2006a, Appendix A). There is no legal or regulatory 'criterion' for such a space-inefficient 81-m pitch between emplacement drifts.

Proposed repository designs as recent as the 2002 Final Environmental Impact Statement or FEIS (DOE, 2002a), however, did not incorporate such a sub-boiling pillar preserved for all time. Instead, it was assumed that the eventual formation of sub-boiling pillars as the rate of radiogenic heating decreased, with lateral water diversion along fractures in tuff, would adequately assure drainage of early-formed condensate water above emplacement drifts that had pitches much smaller than 81-m. For example, a 29-m pitch between emplacement drifts was used in the FEIS design (DOE, 2002a; 2002b) and acceptable repository performance was obtained for such a design.

Furthermore, it should be noted that drift-scale thermal calculations by the USDOE/YMP indicate that the mean average lateral extent of boiling is about 8 m from the drift waters for representative infiltration rates and thermal conductivity (K_{th}) values for tuff (Buscheck et al., 2006). Thus, the 81-m pitch between drifts represents nearly a 4- to 5-fold engineering conservatism compared to the reasonably expected value for lateral extent of boiling, and this 81-m pitch appears considerably larger than is needed to accommodate the expected variability of rock conditions.

10.2 Occupational Health Impacts of an Unnecessarily Wide Disposal Drift Spacing

EPRI agrees that the 81-meter spacing between drifts is unnecessarily wide (EPRI, 2006a; 2007a). Even a drift spacing of half this amount would still provide drainage of groundwater between the drifts. This would approximately halve the required length of the access drifts (as well has halve the repository footprint area, which could impact the probability of igneous activity). *EPRI estimates that reducing the drift spacing to approximately 40 meters would reduce the required length of the access tunnels by approximately four kilometers and the volume of excavated rock by roughly 100,000 cubic meters.*

Appendices B.3.4 and C.3.4 include calculation detail and estimates of the occupational health impacts of unnecessary tunnel excavation. Table 10-1 presents radiological and non-radiological impacts to subsurface workers at Yucca Mountain resulting from the excavation of (potentially unnecessary) four kilometers of access drifts based on estimates for incremental risk per meter of drift excavation.

Table 10 - 1
Additional Worker Dose, Injuries, and Fatalities due to Unnecessary Excavation

Activity	Additional Worker Dose (person-rem)	Additional Worker Injuries and Fatalities
4 km Drift Excavation	48	5.6 TRC 2.4 LWC 0.0015 Fatalities

Although not quantified in this report, there would also be additional, potentially significant occupational risks associated with drift development such as installation of rock support, ventilation equipment, and other subsurface infrastructure.

11
DOE UNDERESTIMATED THE NUMBER OF REQUIRED WET HANDLING FACILITIES

11.1 Potential DOE Wet Handling Facility Throughput Underestimate

DOE's Wet Handling Facility (WHF) is designed to handle all CSNF arriving at the Yucca Mountain site in a container other than TADs. Table 11-1 provides DOE's estimate of the lifetime throughput capacity of the WHF. Based on EPRI's estimates of the number of casks and assemblies that could need to be handled at the Yucca Mountain surface facility, discussed in Section 4.1 of this report, the capacity of the proposed WHF (see Table 11-1) is insufficient to process the anticipated quantity of CSNF that will require processing in that facility.

Table 11 - 1
Wet Handling Facility Design Throughput Capacity over the Pre-closure Period [from DOE (2008b), Table 1.7-5]

	Wet Handling Facility
[Truck] Transportation casks containing uncanistered SNF assemblies (9 BWR or 4 PWR SNF assemblies per cask)	3,775
[Rail] Transportation casks or shielded transfer casks containing a DPC	346
Aging overpacks containing a DPC	346
DPCs (64 BWR or 25 PWR SNF assemblies per canister)	346[c]
SNF assemblies transferred in the pool of the WHF (from an uncanistered-SNF transportation cask or DPC to a staging rack, and from a staging rack to a TAD canister)	66,208[d]
TAD canisters produced at repository (44 BWR or 21 PWR SNF assemblies per canister)	1,165
Aging overpacks or shielded transfer casks containing a TAD canister	1,165

According to the DOE report, "Preliminary Wet Handling Facility Throughput Study", 050-00C-WH00-00200-000-003, ENG.20071102.0019 Informal Study, the WHF is be designed to meet the following throughput criteria:

> The WHF shall be designed to be capable of receiving 230 MTHM per year of bare CSNF from legal weight trucks, over-weight trucks and rail based bare fuel casks, as well as 77 MTHM per year of CSNF in DPCs by rail. In the event that the DOE determines that rail access to the repository site will be unavailable to support system operating conditions and receipt rates, the previous acceptance rates will not apply and will, instead, be based on the availability of truck transportation capability. [050-00C-WH00-00200-000-003, p.13]

The Preliminary Wet Handling Facility Throughput Study estimated the throughput capability of the preliminary WHF design based upon 32 simplifying assumptions, rather than a realistic assessment of anticipated throughput under normal operating conditions. The objective of this throughput estimate was to assist in design development and to provide initial conformance verification that the facility is capable of meeting the assigned processing rates. Results appearing in Table 1 on page 11 of the preliminary throughput assessment are reproduced here as Table 11-2.

Table 11 - 2
Summary of DOE's Proposed CSNF Throughput in the Wet Handling Facility (DOE, 2008b)

Table 1 presents a summary of the throughput model results. For full documentation of throughput model results, refer to Section 5.1.

Table 1. Summary of Throughput Model Results

	Model Results		
Scenario	TADs Produced[a]	Transportation Casks[b]	MTHM[c]
Truck Only	36	191-192	309-315
DPC Only	46-47	44-46	410-418
Mix of Truck and DPC	40-52	61-147	363-464
Small, Med, Large Rail Bare CSNF	54-74	60-138	461-627

Notes: [a] See Table 4 [b] See Table 6 [c] See Table 5

Criterion 3.1.1 requires the WHF to be able to process a combined 307 MTHM per year. The results presented in Table 1 show that the WHF meets the throughput requirement for waste streams containing truck only, mix of truck (bare-fuel) and DPC transportation casks, and DPC only cases.

050-00C-WH00-00200-000-003, p.11

Many of the simplifying assumptions that the preparers of the report acknowledge make their predictions optimistic. Three of the most significant are Assumptions 1, 3 and 32.

Assumption 3.2.1 states, "On demand delivery conditions were used in the throughput model. All inputs, such as loaded transportation casks and new TADs, were available when required. All outputs, such as empty transportation casks, empty DPCs, and loaded TADs, were removed when ready." This assumption requires that all supporting activities external to the WHF be available at all times when the WHF is operational, which is unrealistic. The study made this assumption to limit the scope of the assessment to the WHF, and the authors state that this assumption is suitable for use in only a preliminary engineering study. In making this assumption, they state that it produces an "optimistic", i.e., non-conservative, result.

Assumption 3.2.3 states, "For the purposes of this preliminary throughput study, facility availability was assumed to be 75 percent. The 25 percent non-availability was used to account for routine maintenance and equipment failures, off-normal operations, and recovery time." In essence every potential delay is covered by the 25 percent non-availability.

Assumption 3.2.32 states, "Manpower will be sufficient to support all operational phases based on the WHF operating on the operational work week schedule. This assumption includes sufficient personnel to support activities required to be performed concurrently identified in this throughput." This assumption requires that sufficient personnel be hired, trained, and retained to

cover all potential disruptions, such as sickness, vacation, holidays, mandatory training, etc., which is extremely difficult to accomplish.

To account for all potential delays the assessment assumes that the facility will be available 75% of the year.

In presenting the results, the report acknowledges the potential impact of the assumptions on page 10 prior to presenting the results: "The model results are considered optimistic, and per Assumption 3.2.1, outside factors are not represented in the WHF model specifically. While not known in detail, it is anticipated that the outside factors will degrade the performance of the WHF. The primary outside factors include sequencing, the delivery of trucks from truck staging, railcars from rail staging, export of TADs within aging overpacks to either the CRCF or Aging Facilities, delivery of empty TADs, and arrival of site transporter from the Receipt Facility and the Aging Facilities."

Criteria 1.3.1, to which the WHF throughput is being designed, appears to be too low in light of the inventory of dry storage casks currently in dry storage and the number of DPC and dry storage casks that are and continue to be generated by the utilities prior to the availability of the TAD.

Scenarios for Wet Handling Facility CSNF Processing Throughput Needs

EPRI considered three bare fuel, dual-purpose canister (DPC) scenarios that would be shipped to Yucca Mountain by a combination of truck and rail in order to estimate the required number WHFs:

1. DOE's Proposed Action;
2. DOE's Proposed Action except 100% of the DPCs are assumed to be shipped to Yucca Mountain; and
3. EPRI's projected number of casks, canisters and assemblies arriving at Yucca Mountain not in TADs (per EPRI's estimates in Section 4).

EPRI also used these same three scenarios to evaluate the additional processing time required if just one WHF were available.

11.1.1 Number of WHFs Needed to Process the CSNF in 24 Years

Scenario 1: DOE's Proposed Action

According to DOE's Proposed Action, the following numbers of transportation casks and assemblies are anticipated by DOE:

- By rail: 307 DPCs (22,917 assemblies) – 13 DPCs per year
- By truck: 2,650 casks (13,944 assemblies) – 110 casks per year
- 22,428 PWR and 14,433 BWR assemblies for a total of 36,861 assemblies

Comparing to Table 10-1 from Preliminary Wet Handling Facility Throughput Study shown above, one WHF should be sufficient to handle all the casks, DPC canisters, TADs and Aging Overpacks in DOE's Proposed Action.

Scenario 2: 100% of the Projected Number of DPC are Shipped to Yucca Mountain

However, if *all* of the DPCs DOE projects to exist, prior to the widespread use of TADs, are shipped under Proposed Action (during the 24-year pre-closure loading phase DOE proposed), but still assuming the same number of truck casks in DOE's Proposed Action, then the following number of DPCs and truck casks would need to be handled in a WHF:

- By rail: 966 DPCs (37,435 assemblies) – 40 DPCs per year
- By truck: 2650 casks (13,944 assemblies) – 110 casks per year
- 24,940 PWR assemblies and 26,439 BWR assemblies for a total of 51,379 assemblies

This would result in an average of 150 casks being processed through the WHF annually – somewhat more than DOE's estimate of 61 to 147 casks for a mix of truck and DPCs as identified in the Table 1 above, from the Preliminary Wet Handling Facility Throughput Study. Thus, the design capacity of the WHF is not sufficient throughput to handle the total 966 DPCs that DOE has estimated will be loaded for dry storage at reactor sites along with 2,650 truck casks. Depending upon whether one assumes the high or low range of cask throughput (61 to 147 casks) – the facility may need to be expanded by as little as 5% or by more than double the design capacity. Thus, assuming the lower throughput, two wet handling facilities would be needed.

Scenario 3: EPRI's Projected Number of Assemblies not in TADs

The following is a summary of EPRI's projected number of DPCs that will exist at the time TADs enter widespread use in the industry: Using EPRI's 2,375 DPC number

- By rail: 2,375 DPCs. This is based on the following:
- 28,820 assemblies in the 845 canisters already loaded
- 67,550 assemblies in the 1,530 canisters projected to be loaded.
- Total assemblies: 96,370 composed of 44,525 PWR and 51,845 BWR assemblies

In EPRI's estimate of the total number of DPCs that may be loaded at reactor sites by 2020, EPRI assumed that the sites that DOE identified as shipping by truck would actually ship CSNF via large capacity rail casks. Some of these sites would load DPCs for at-reactor storage and are included in EPRI's estimate that as many as 2,155 DPCs and an additional 220 storage-only canisters may be loaded at reactor sites through 2020 and shipped to the repository. If these packages must be unloaded in the WHF, this would result in a total of 2,375 canister systems being unloaded during the 24-years of the Proposed Action, or an average of 99 DPCs or canisters per year. The total CSNF assembly throughput for the WHF would be 96,370 assemblies, or an average of 4015 assemblies per year.

As noted in the Preliminary Wet Handling Facility Throughput Study, in a DPC-only scenario, a total of 44-46 DPC transportation casks could be unloaded annually at the WHF. This is less than half of the average of 99 DPCs that would have to be handled using EPRI's estimate of 2,155 DPCs or canister systems. Thus, if utilities load as many as 2,375 DPCs and the DPCs are transported to the repository during the 24-year Proposed Acton, it appears that the WHF throughput would not be adequate to handle these additional packages and that the WHF

capacity would have to be doubled. DOE has not assessed the worker impacts associated with construction and operation of an additional WHF.

11.1.2 Additional Processing Time if Just One WHF were Available

Alternatively, for Scenarios 2 and 3 one WHF could be adequate, but it would take a longer period of time to process all the casks, canisters, and assemblies arriving in non-TADs.

If just one WHF were required to handle the amount of CSNF not in TADs described in Scenarios 2 and 3 above, a rough estimate of the additional amount of time is as follows. It is assumed that the maximum number of bare fuel, DPCs, and assemblies DOE can handle in a single WHF is based on Table 11-1. Furthermore, it is assumed that it takes 24 years for DOE to handle this amount of CSNF.

Scenario 2

Cask-limited:

For this estimate, it is assumed that DOE can process the same number of casks whether by truck or rail. However, it is likely that it will take a longer period of time to process a DPC arriving by rail that bare fuel arriving by truck. This is because there are extra steps involved in processing a DPC compared to processing bare fuel.

- Number of casks requiring processing: 966 (DPCs) + 2650 (truck) = 3616
- Number of casks DOE can process in one WHF in 24 years: 346 (DPCs) + 3775 (truck) = 4121

Therefore, based on the conservative assumption that it takes the same amount of time to process 4 PWR or 9 BWR assemblies arriving as bare fuel in a truck cask, and >24 PWR or >40 BWR assemblies arriving in a DPC, one WHF could process all the assemblies in Scenario 2 in 24 years. Since it is more likely that it will take longer to process a DPC than a truck cask, it is likely that it will take somewhat more than 24 years to process the CSNF arriving as described in this scenario.

Assembly-limited:

- Number of assemblies requiring processing: 61,669
- Number of assemblies that one WHF can process in 24 years: 36,861
- Number of years to process 61,669 assemblies: 24 X (61,669/36,861) = 40 years

Therefore, it would require an additional 16 years to process the additional amount of CSNF in this scenario, assuming the WHF processing time is somewhat insensitive to whether the assembly being processed is from a PWR or a BWR.

Scenario 3

Cask-limited:

- Number of casks requiring processing: 2375 (DPCs) + 2650 (truck) = 5025
- Number of casks DOE can process in one WHF in 24 years: 346 (DPCs) + 3775 (truck) = 4121

- Amount of time to process: 24 years X (5025/4121) = 29 years

Therefore, if processing time in the WHF is limited by the number of casks that can be handled, then it would take a minimum of five additional years to process the required number of casks. In reality, it is likely to take considerable more than five additional years as this estimate assumes the same amount of processing time for a DPC arriving in a rail cask and 4 to 9 assemblies arriving bare in a truck cask.

Assembly-limited:

- Number of assemblies requiring processing: 96,370
- Number of assemblies that one WHF can process in 24 years: 36,861
- Amount of time to process: 24 years X (96,370/36,861) = 63 years

Therefore, if processing time in the WHF is limited by the number of assemblies that can be handled, then it would take a on the order of 39 additional years to process the required number of assemblies.

The incremental occupational health risk due to a one-year delay in the availability of Yucca Mountain is described in Section 5-2. Estimates of the potential delay if one WHF is available is between 0 and 39 years, although the delay may be longer than 39 years it if takes longer to process one, large DPC compared to one small truck cask, which is likely.

11.2 Impacts of an Insufficient Number of Wet Handling Facilities

For Scenarios 2 and 3, it would be necessary to institute some combination of increasing the number of WHFs and decreasing the amount of time required for processing the necessary quantity of casks, canisters, and assemblies in a single WHF. Any solution would delay the ability of Yucca Mountain to receive CSNF in any container other than a TAD. While not discussed in any detail in this section, either alternative would also incur additional cost.

If additional WHF were required, it is possible that DOE would need to build them over several years as DOE may be funding-limited. Given the considerable cost of constructing such a facility and the need to obtain requisite funding, the additional time required to complete construction of additional WHFs could be significant. Construction of additional WHF(s) will also cause an increase in occupational health risk due to the necessary construction and material requirements.

If it takes longer to process an additional amount of CSNF in a single WHF, then the utilities would incur both additional costs and occupational health risk as it would become necessary for the utilities to keep non-TAD containerized CSNF in storage at their sites for a longer period of time. The occupational health impact due to a one-year delay in the opening of the Yucca Mountain repository has been described in Appendix B and C, and summarized in Table 5-2 of this report.

11.2.1 Occupational Health Impacts Associated with the Construction of Additional Waste Handling Facilities

As described in Section 7.2, EPRI chose to evaluate the occupational health impacts on more generic, semi-quantitative level by calculating concrete volumes required for construction of a

stylized Yucca Mountain surface facility based on the available dimensions for the Waste Handling Facility footprint, the typical above-grade height, and wall thickness. Accordingly, the example is applicable to this discussion as well. This illustration assumes a WHF facility comprised solely of a rectangular concrete shell -- an extremely conservative assumption that neglects interior walls, and contributions from the roof and foundation components. The data, assumptions, calculations are described in Section C.3.6.

As described earlier, this simplistic approach was necessitated by the lack of data provided in the License Application due to the designation of design information as "Official Use Only" in the public document.

For a representative structure derived from the description provided in the LA for the WHF, the concrete volume of 438,400 ft^3 was calculated for the 4-foot thick exterior walls occupying an ITS footprint of 385 ft. x 300 ft. For a ready mixed concrete truck capacity of 240 ft^3, this corresponds to a total of 812 truck loads.

The construction of one or more additional WHFs represents a major undertaking in terms of costs, materials, and workforce. Along with the significant requirement for construction related workers come some of the highest occupational risks of any industry. As highlighted in Section 7.2 and Table C. 9, the Bureau of Labor Statistics singled out three specific occupational subcategories, structural iron and steel workers, truck drivers, and construction laborers, associated with exceptionally high fatality rates and would be comprise the majority of the workforce for WHF construction.

In lieu of specific occupational risk estimates for the WHF construction, fatality rate data from Table C-9 and injury/fatality rate data from Table C-10 are presented below (Tables 11-3 and 11-4).

Table 11 - 3
Selected occupations with high fatality rates for 2005 (BLS, 2006a)

Occupation	Fatalities (per 100,000)
Structural iron and steel workers	55.6
Driver/sales workers and truck drivers	29.1
Construction laborers	22.7

The reinforcement of concrete structures to withstand seismic loads directly involves all three of these high-risk occupations for the preparation of appropriate concrete forms, assembly of additional rebar, and pouring of additional concrete. Additional concrete also results in additional truck deliveries that could number in the 100's to 1000's for the case of an over-designed facility. Accordingly, the purposeful over-design (beyond standard engineering margins) for seismic or any other hazard represents unnecessary and unjustified imposition of risk to the involved workers.

Table 11 - 4
Relevant BLS[a] and DOE[b] Non-radiological Injury and Fatality Rates

Category	TRC	LWC	Fatalities

BLS - construction	6.3	3.4	11.0
BLS - warehousing and storage	8.2	5.4	17.6[c]
BLS - truck transportation	6.1	3.9	17.6[c]
DOE - construction period[b]	2.0	0.86	0.55

[a]BLS, 2006a,b
[b]DOE 2008, YMSEIS, Table 4-16), Section 4.1.7.1
[c]Fatalities for transportation and warehousing category, NAICS code 48-49

11.2.2 Occupational Health Risk Increase Caused by Additional Time to Process CSNF in One WHF

As described in Section 10.1.2, the additional processing time if just one WHF were available would range between zero and perhaps over 39 years. Appendices B and C include estimates of the occupational health risk associated with a one-year delay in the initiation of CSNF shipments from the reactor sites to Yucca Mountain. These numbers would need to be multiplied by a range of 0 to •39 to provide a rough estimate of the additional occupational health risk due to this delay.

11.2.3 Economic Impacts of Additional WHF Construction

Based on a DOE cost estimate contained in a 2007 DOE budget projection for expenditures from FY2009-FY2023 (DOE 2007), the costs for construction of the Initial Handling Facility ("IHF" which would handle canistered naval reactor SNF and DHLW) and the WHF were estimated to be $615 million. EPRI conservatively assumed that both of these facilities would have equal cost, although it should be noted that the WHF has more complex handling operations and would be expected to have a higher cost than the IHF. This results in an estimated cost to construct additional WHF of $307.5 million.

12

DOE HAS OVERESTIMATED POST-CLOSURE DOSE TO THE PUBLIC DUE TO CONSERVATISM IN REPOSITORY PERFORMANCE ASSESSMENTS

12.1 Technical Bases

There are multiple conservatisms in DOE's repository performance assessment that result in an overestimate of post-closure dose to the pubic. DOE (2008b), Section 1,8 describes these conservatisms. DOE notes the following about the models incorporated into its TSPA-LA:

> The submodels incorporated into the TSPA-LA Model are representations of the repository system. The guiding principles during the development of these submodels were to: (1) ensure that representations were not optimistic (i.e., leading to an underestimation of the dose results), and (2) incorporate all included FEPs. Although these representations were developed to be as realistic as possible, some conservative (reasonable and technically defensible based on supporting analyses) representations were required for complete development of the TSPA-LA. Model. [DOE (2008b), Section 1.8]

These conservatisms include, for example:

1. Overestimate of the importance of colloid-aided radionuclide transport to the biosphere;
2. No credit has been taken by DOE during the post-closure period for the integrity of the rock support system. Given the robust design of the rock support systems, it is likely that this system will continue to perform for potentially a significant amount of time after the repository is closed. This could provide additional protection from rockfall to the underlying engineered barrier system (EBS) components during the early period of highest rock stresses and highest radionuclide activity.
3. No credit is taken for the degradation rate of the stainless steel TAD canister or the inner stainless steel layer of the disposal overpack. Again, if credit were taken for these stainless steel layers, release of radionuclides from the repository would be further delayed;
4. Overestimate of the amount of carbon-14 that would be transported downstream;
5. Overestimate of neptunium solubility, an key actinide for the long-term repository performance.

12.1.1 Colloids

Radionuclides that are retarded in natural systems due to sorption to soil/rock surfaces and/or low aqueous solubilities are potentially subject to rapid transport in the subsurface due to mobile colloid phases. Such facilitated transport processes are especially important for strongly sorbing and low solubility actinides such as Pu.

EPRI has conducted a thorough review of the properties of relevant colloids and the mechanisms by which the different classes of colloids could conceivable operate to enhance the mobility of otherwise immobile radionuclides to the RMEI at the compliance location [EPRI, 2006, # 1013440]. In order for colloid-facilitated transport to play a significant role in the dose to the RMEI, several conditions must exist simultaneously, including the following major ones:

- Colloids must form in sufficiently large numbers to provide sufficient surface area for transport of the inventory of radionuclides;
- Colloids must remain stable for the relevant distance to the RMEI (kilometers) and timeframe (10^4 years);
- Colloids must not be subject to significant reversible or irreversible filtration by the geologic media.

EPRI has determined that none of these conditions will be met for the relevant timeframes and physical scales. Accordingly, it is appropriate to screen colloidal transport out of performance assessment modeling as a dose-significant process.

Moreover, DOE recently replaced mild steel with stainless steel inserts in the proposed standardized TAD canister; in doing so, DOE has also eliminated the potential for formation of iron-oxide/ hydroxide based colloids.

By choosing not to screen facilitated colloidal transport out as relevant process, DOE adds unnecessary complexity into an already complex modeling environment and introduces another layer of conservatism.

12.1.2 Rock Support System Integrity

The rock support system DOE proposes to use is likely to last longer than the time of repository closure. EPRI has not yet studied the issue of long-term rock support integrity, but assuming it does last even a few additional decades, this would be well into the period of maximum EBS temperatures. A generally sound rock support system during this period could prevent any significant amount of rockfall to occur. Given the relatively low relative humidity during the period of the highest temperatures after repository closure degradation of the rock support system via corrosion would likely remain low.

Preventing significant rockfall through the peak temperature period after repository closure could help to reduce damage to the underlying drip shields and waste packages, and could reduce the amount of groundwater seepage into the drifts.

12.1.3. Degradation of Stainless Steel Components of Waste Package

As discussed in Section 6.1.6 above, neglecting the potential structural and radionuclide migration mitigation performance of the outer stainless steel shell of the TAD and the inner stainless steel shell of the waste package is conservative. If DOE had considered these two potential EBS barriers, then DOE would have found improved structural resistance to seismic activity and rockfall, and reduced radionuclide migration rates out of the waste package after waste package failure.

12.1.4. Carbon-14

The DOE approach to C-14 in the waste form, near-field, and far-field is overly conservative, resulting in C-14 representing the second highest dose contributor for the early period of performance -- on the order of 0.04 mrem per year at 10,000 years (DOE, 2008a). Only Tc-99 yields a higher dose, 0.1 mrem/yr, at 10,000 years. Similarly, C-14 also ranks no. 2 in dose contribution for the first 10,000 years for the nominal and seismic ground motion scenarios as a result of DOE's overly conservative approach. In TSPA performance margin analyses, DOE reports C-14 to be the third highest dose contributor for the first 10,000-year period (DOE, 2008a, Vol. III, App. C, p. C-96, 2008).

The factors contributing to C-14's prominent role in early dose include: high solubility in a carbonate/bicarbonate form (CO_3^{2-}/ HCO_3^-), non-sorption, and relatively long half-life with respect to the 10,000-year timeframe. C-14 is treated similarly to Tc-99 and I-129 as a high-solubility, non-sorbing radioisotope (DOE, 2008a, Vol III., p. 8.1-8). No mention appears to be made of C-14 exchange with naturally occurring carbon in groundwater and air in unsaturated tuffs that would lead to substantial evolution of C-14 as a gas prior to transport to RMEI location.

DOE reports that release rates of C-14 from the waste package/waste form, along with Tc-99 and I-129, are limited only by waste form degradation rate, rate and extent of water ingress into WP, and mass transport out of WP (DOE 2008a, Vol III., p. 8.1-8). DOE further claims that C-14 will be transported to the RMEI at the same rate as groundwater (i.e., as a conservative tracer), and will not be subject to retardation or losses other than radioactive decay. Again, this indicates that DOE dose not consider any well-established gas-exchange reactions (occurring over relatively short time frames, of days to weeks, with respect to transport through the unsaturated zone), evaporation, weathering, isotopic fractionation, or precipitation reactions, which would serve to deplete C-14 concentrations in water exiting the engineered barrier system or result in C-14 incorporation into existing and prevalent carbonate minerals within the unsaturated and saturated zones (Langmuir, 1997; Stumm and Morgan, 1981).

Moreover, carbon (as C-14) generated in spent fuel via neutron activation of nitrogen impurities in fuel and hardware components is expected to be in a reduced chemical form (graphite) because of the reducing conditions prevailing during reactor operations. Graphite, as a common material used in such consumer items as pencils and lubricants, does not readily oxidize into carbonate at atmospheric pressure and expected repository temperatures. DOE, however, conservatively assumes that all of the initial C-14 embedded in the fuel matrix and hardware immediately oxidizes to form a highly soluble carbonate or bicarbonate species when contacted by groundwater. By foregoing known and well-understood geochemical reactions and kinetic constraints, DOE (2007) conservatively considers C-14 to be instantaneously released as a 'highly soluble' radioelement.

In the unlikely event that C-14 is released as a soluble carbonate/bi carbonate species, it is important to note that the typical groundwaters in Yucca Mountain tuffs are close to saturation with respect to calcite, a condition confirmed by the prevalence of calcite in fractured tuffs (Paces et al., 2001). For the five cited reference groundwaters (Table 12-1), the calculated mean solubility concentration, with 2-sigma standard deviation, for calcite is $10^{-3.08\pm0.78}$ moles/L. The actual concentration of C-14 in equilibrium with calcite would be further lowered by consideration of normalizing the calcite solubility value by the relative ratio of trace C-14 to the

total mass of all naturally occurring carbon isotopes (C-12 and C-13), the so-called isotopic mass fraction.

Accordingly, , if it is conservatively assumed that all of the C-14 can be oxidized and mobilized from spent fuel as carbonate/ bi-carbonate species, the prevailing geochemical conditions at Yucca Mountain would impose rather low values to the range in possible C-14 concentration. For calcite, a 'high' solubility value = 5.0 E-3 moles/L, the 'mid' solubility value = 8.3 E–4 moles/L, and the 'low' solubility value = 1.4 E–4 moles/L are adopted as the reasonably expected solubility values from Table 12-1 compositions. These values would have to be, in turn, reduced by the extremely small mass-fraction of C-14 compared to all carbon isotopes.

Table 12 - 1
Compositions of Representative Yucca Mountain Waters (from Table 6.2-1 of BSC 2003)

Porewater ID	W0	W5	W4	W6	W7
Lithostratigraphic Unit	Tptpmn	Tptpul (base)	Tptpll	Tptpll	Tptpul
Temperature (°C)	25	25	25	25	25
pH	8.3	7.6	7.4	7.9	8.0
Na^+ (mg/L)	61.5	39.0	130.0	84.0	57.0
K^+ (mg/L)	8.0	7.6	10.6	7.9	10.3
Ca^{2+} (mg/L)	101.0	94.0	82.0	56.0	120.0
Mg^{2+} (mg/L)	17.0	18.1	5.3	0.9	19.3
$SiO_2(aq)$ (mg/L)	70.5	42.0	48.0	50.0	49.0
Cl^- (mg/L)	117.0	21.0	26.0	23.0	54.0
SO_4^{2-} (mg/L)	116.0	36.0	39.0	10.0	78.0
HCO_3^- (mg/L; calc)[1]	200.0	395.0	515.0	335.0	412.0
NO_3^- (mg/L)	6.5	2.6	4.2	17.0	6.1
F^- (mg/L)	0.9	3.4	6.0	2.5	4.8

[1] Total aqueous carbonate as HCO_3^- (mg/L), calculated from charge balance.

The remaining C-14 in groundwater would be further attenuated by previously mentioned processes such as gas-water exchange, weathering reactions with alumino-silicate minerals, and evaporation.

From a performance margin viewpoint that for the ambient environmental conditions prevailing at the time of initial container failures (1 atmosphere pressure, temperature below 96°C), if carbon-14 is present as graphite, this form of carbon can remain chemically inert for geological time scales. Furthermore, even if the reduced C-14 becomes oxidized to and is transported as soluble carbonate/bicarbonate species from the near-field of a repository, numerous well-established and naturally evident processes would act to attenuate a significant fraction of C-14 dissolved in groundwater during transit in the unsaturated and saturated zones. All of these factors provide additional performance margins to attenuate or retard the release of C-14 and are not accounted for in DOE's evaluation of Yucca Mountain performance. The net result of these physical-chemical partitioning processes would be a substantial reduction or retardation of the C-14 inventory that would be transported to the RMEI location.

12.1.5 Neptunium Solubility (EPRI, 2005c)

Performance assessment modeling indicates that, after 10,000 years, neptunium-237 (Np-237) and its decay products are dominant contributors to RMEI dose. Because of its long half-life (2.14×10^6 years), the peak dose from Np-237 at the compliance point scales proportionally with the solubility limit for Np. Therefore, a realistic determination of Np solubility behavior in the proposed repository is important for reasonable performance assessments and determination of regulatory compliance for Yucca Mountain.

Previously, the U.S. Department of Energy (DOE) has identified and evaluated three conceptual models to define the maximum concentration of Np at the surface of dissolving spent nuclear fuel (Chen et al., 2002; DOE, 2003):

A *base-case conceptual model*, in which it is conservatively assumption that maximum Np concentrations are limited by the solubility of crystalline Np_2O_5(cr). This Np(V) phase has a solubility of about 10^{-5} M (2.4 mg/L) Np in repository groundwaters (cf. Friese et al., 2004).

A *first alternative conceptual model* that assumes that maximum Np concentrations are determined by the solubility of the Np(IV) solid phase NpO_2 (cr) in the same oxidized groundwaters that were assumed for the base-case model (DOE, 2003). There is evidence that NpO_2(cr) is thermodynamically more stable than Np_2O_5(cr) in the repository (Roberts et al., 2003). The DOE's modeled solubility of NpO_2(cr) is about 1.2 log units (a factor of 17) lower than that of Np_2O_5(cr) (DOE, 2003).

The License Application apparently assumes a combination of the base-case and first alternative conceptual models for Np solubility control. The "Dissolved Concentration Limits of Elements with Radioactive Isotopes" report (Sandia, September 2007, ANL-WIS-MD-000010 Rev 06, DOC 20070918.0010), which provides the data used in the License Application, notes (Sandia, 2007, pages 6-66 to 6-67) that both NpO_2 (a Np (IV) phase) and $NaNpO_2CO_3$ (a Np (V) phase) are considered as solubility-controlling phases inside failed waste packages in which reducing materials (e.g., fuel or steel) are still present, whereas Np_2O_5 and $NaNpO_2CO_3$ (both Np (V) phases as in the *base-case conceptual model*) are assumed if all reducing material is corroded within a failed waste package.

A *second alternative conceptual model* previously identified by the DOE, also described as the *secondary phase neptunium solubility model* (DOE, 2003), assumes that maximum Np concentrations are determined by precipitation of the Np from spent fuel dissolution in solid solution with major secondary uranium minerals. The DOE did not adopt this model in the LA because it was not considered sufficiently supported by experimental evidence (Sandia, 2007, page 6-67). The DOE has previously recognized (DOE, 2003), however, that Np concentrations predicted with this secondary phase neptunium solubility model are in excellent agreement with the concentration of Np released by dissolution of spent fuel, a value which is typically in the range of 10^{-8} to 10^{-10} M, whereas Np concentrations predicted using the base case model or first alternative conceptual model are 3 or more orders of magnitude higher (i.e., more conservative) than experimental evidence.

Based on a review of available published studies presented in this report, EPRI believes that DOE's base case assumption that Np_2O_5(cr) solubility defines maximum possible Np concentrations at Yucca Mountain is unrealistically conservative for the following reasons:

- Pure Np phases have never been observed to precipitate in spent fuel leaching experiments (DOE, 2003). There is no evidence that Np concentrations from the leaching of spent fuel will ever be high enough to result in the precipitation of pure Np(V) phases such as Np_2O_5(cr).
- Thermodynamic databases developed by the DOE (Kaszuba and Runde, 1999; DOE, 2000a), and independently by international groups (Lemire et al., 2001; Guillaumont et al., 2003), indicate that NpO_2(cr) is probably more stable than Np_2O_5(cr) under all repository conditions.
- Laboratory experiments at 90°C and above in oxidized waters have precipitated NpO_2(cr) (Finch, 2001; DOE, 2001; Roberts et al., 2003), suggesting that Np(V) phases such as Np_2O_5(cr) are metastable and, with time, will convert to more thermodynamically stable and less soluble NpO_2(cr) in the repository.
- In experiments most closely simulating the heterogeneous conditions expected during the dissolution of spent fuel in the repository, the Np/U ratio of the leachates is the same as the Np/U ratio of the fuel, and Np concentrations do not increase with time relative to uranium concentrations as secondary uranyl minerals are formed (DOE, 2003). This confirms active uptake and incorporation (co-precipitation) of trace Np into secondary uranyl minerals at approximately the same Np/U ratio as was present in the spent fuel. Resultant Np(V) concentrations can be expected to be extremely low ($<10^{-7}$ to 10^{-9} M) and controlled by the solubility of secondary uranyl minerals and the mass fraction of Np incorporated in those minerals.

Based on these results, it is EPRI's position that, of the three models considered by the DOE, the second alternative conceptual model, the secondary phase neptunium solubility model, is the most realistic and technically defensible to evaluate the long-term release behavior of Np from a repository at Yucca Mountain. The other conceptual models based on the formation and solubility of pure Np-solids are considered to be unrealistic and conservatively bounding.

There is another factor why Np releases from a repository at Yucca Mountain can be expected to be low, providing even more evidence of the conservatism of the base case model. Combined sorption and reduction of Np (V) to Np (IV) can also be expected in groundwater migrating beneath the repository via matrix flow through vitric layers in the tuffs of the Calico Hills Formation[4]. A number of researchers have shown the tendency for Np(V) to be adsorbed by tuff minerals such as magnetite (and probably also ilmenite) that contain Fe(II), with reduction of Np(V) and its retention as less soluble Np(IV) species (Nakata et al., 2002; 2003).

Based on these multiple lines of evidence and reasoning, EPRI concludes that Np concentrations released from a repository at Yucca Mountain will be controlled at values below 10^{-7} M by co-precipitation in secondary uranyl minerals in the near field, and by reduction and sorption as Np(IV) in underlying tuff formations. To purposefully adopt an excessively conservative alternative conceptual model for Np solubility imposes an unwarranted perception of potentially higher doses resulting from a repository at Yucca Mountain than is reasonably supported by data from the DOE and independent international scientific peer groups.

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[4] Assuming its composition is similar to that of the overlying Topopah Spring Tuff as described by Peterman and Cloke (2002), the Calico Hills contains the Fe(II)- bearing minerals magnetite, ilmenite and pyrite at 0.19, 0.18 and 0.09 average weight percent, respectively.

12.2 Potential Impacts

Because DOE's multiple conservatisms lead DOE to overestimate dose rates to the RMEI, the repository system design may be more robust than a repository design based on a different design based on more reasonable assumptions and data inputs to DOE's dose assessment calculations. This could lead to increased time requirements for the design and/or construction of the associated facilities.

A secondary issue is that DOE's conservatisms make the dose estimates appear as if there is only a limited amount of margin below the proposed EPA and NRC dose limits. The more limited the margin between the calculated performance and the established regulatory limits, the greater the potential for increased regulatory scrutiny. Such scrutiny might result in extension of the regulatory process and/or increased litigation regarding any conclusions reached by the regulator.

As discussed in Section 5.2 and Appendices B and C., any delays in the licensing, construction, and operation of the repository places additional radiological and non-radiological risk burdens on workers at the utility sites due to the need to construct additional ISFSI capacity; to extend and/or expand inspection and maintenance programs for existing ISFSI facilities at operating plants

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A
EXISTING AND PROJECTED QUANTITIES OF COMMERCIAL SPENT NUCLEAR FUEL CANISTERS

A.1 Evaluation of Commercial Spent Nuclear Fuel Packaging Scenarios

The Transportation, Aging, and Disposal canister is the only recognized disposable canister for commercial spent nuclear fuel in DOE's license application. The TAD reflects an evolution of an earlier standardized disposal package. The TAD capacity is relatively small with respect to many commercially available canister designs, accommodating only 21 PWR or 44 BWR assemblies. DOE's proposed action for the design and operation of Yucca Mountain accommodates a limited amount of CSNF arriving at the repository in DPCs and other non-TAD-packaging. DOE proposes a baseline of up to 10% of non-TAD CSNF and also evaluates an alternative scenario for up to 25% of inbound non-TAD packaged CSNF [DOE SEIS, 2008]. The consequences of DOE's approach to disposal canister design, repository design, and operations cascade throughout the repository system and extend out to the nuclear utilities, workers, and the general public. Accordingly, understanding the various quantities of DPCs, TADs, and other containerized forms of CSNF is central to evaluating the impacts of DOE decisions relative to the storage, transport, and disposal of CSNF.

EPRI analyses suggest that many of the existing dual-purpose canisters (DPCs) used by the nuclear industry could be safely transported, aged, and disposed of at Yucca Mountain (EPRI, 2008a). Currently licensed DPCs hold approximately 1.14 to 1.55 times as much spent nuclear fuel as do the proposed TADs. Thus, using the proposed TAD size instead of DPCs or larger capacity TADs will result in a larger number of canisters being loaded at nuclear utility sites, transported to Yucca Mountain, potentially aged, and then disposed.

DOE also assumes that SNF from seven commercial nuclear power plants as well as two national laboratories would be transported to Yucca Mountain utilizing truck casks with capacities of 4 PWR assemblies or 9 BWR assemblies. All of the commercial nuclear power plant sites that DOE identifies as using truck casks have plans to or are expected to load large rail-capable DPCs for on-site storage of CSNF. Therefore, in addition to evaluating the impacts associated with DOE's assumed TAD capacity, EPRI also evaluated the impacts to workers associated with the transport of CSNF in truck casks rather than in DPCs or large capacity TADs.

Table A-1, below, provides a summary of the types of packages that DOE assumes will be used to transport CSNF to the Yucca Mountain repository under the 70,000 MTU base case compared to transportation cases identified by EPRI. DOE's Final Supplemental 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 (YMSEIS) assumed that a total of 6,499 TADs, 307 DPCs, and 2,650 truck casks would be loaded with CSNF and transported to Yucca Mountain under the Proposed Action (70,000 MTU repository capacity). In addition, EPRI considers two alternative scenarios, EPRI Case 1 and Case 2, which are described as followes:

- EPRI Case 1 assumes that the sites that DOE identified as loading and transporting 21P/44B TADs instead load larger capacity TADs; a small number of previously loaded DPCs are transported; and that the truck sites identified in the YMSEIS (DOE, 2008a) ship CSNF by truck. This results in the shipment of 4,591 larger TAD packages, 307 DPCs and 2,650 truck casks. EPRI Case 1 is conservative since all of the sites identified by DOE as truck sites have plans or are expected to load large-capacity DPCs for on-site storage.
- EPRI Case 2 assumes that sites identified as loading and transporting 21P/44B TADs instead load larger capacity TADs and that commercial reactor sites designated as truck sites also load larger capacity TADs instead of truck casks. This results in the shipment of 4,928 larger TAD packages, 307 DPCs, and 2 truck casks.

Table A - 1
Estimated Reduction in Number of CSNF Packages Loaded and Transported Associated with Use of Larger TAD Designs

Package Type	DOE YMSEIS	EPRI – Case 1 With Truck Casks	EPRI – Case 2 Minimal Truck Casks
TAD 21P/44B	6,499		
Large Capacity TAD 24P/32P,61B,68B	0	4,591	4,928
DPC	307	307	307
Truck	2,650	2,650	0
Total Casks Shipped	9,456	7,548	5,239

A.2 Projections for Quantities of Dual-Purpose Canisters Loaded at Reactor Sites

The YMSEIS assumes that a total of 307 DPCs and storage-only canister-based systems would be shipped to the repository and unloaded at the repository under the 70,000 MTU repository case and that a total of 966 DPCs would be shipped to the repository and unloaded at the repository if the full MTU of CSF is assumed. (DOE 2008c, Transportation File, Trans data_Summary.xls)

As of May 2008, approximately 625 DPCs had been loaded into ISFSIs for on-site storage at commercial nuclear power plant sites. EPRI has projected that an additional 1,530 DPCs could be loaded at reactor sites between 2008 and 2020. Thus, a total of 2,155 DPCs could be loaded at reactor sites through 2020. EPRI's projection of DPCs loaded through 2020 assumes that nuclear operating companies continue to load DPCs rather than TAD canisters for on-site storage through that date, although it is possible that companies would begin loading TAD canisters at an earlier date if they are available.

In order to estimate the number of additional DPCs loaded through 2020, EPRI projected CSNF discharges for all currently operating nuclear power plants. Average annual spent nuclear fuel

discharges are expected to be in the range of 2,100 to 2,300 MTU per year through 2020. Using current and planned CSNF storage pool capacities and projected CSNF discharges, EPRI estimated that approximately 1,700 MTU of dry storage capacity would be needed at nuclear power plant sites annually through 2020. This projection of additional on-site storage assumes that all U.S. licensed nuclear power plants continue to operate through the end of their 60-year extended licenses; that lifetime capacity factors average approximately 90%; and that average discharge fuel burnups gradually increase to 58,000 MWD/MTU for PWRs and 46,400 MWD/MTU for BWRs.

In estimating the number of DPCs loaded through 2020, EPRI assumed:

- Plants with existing ISFSIs that are loading CSNF into metal dual-purpose casks would continue to do so through 2020.
- Plants with existing ISFSIs would continue to load CSNF into packages with similar capacities through approximately 2013.
    - Plants that are now loading 24-PWR DPCs with approximately 10 MTU per DPC, would continue to do so through 2013.
    - Plants that are currently loading 32-PWR or 61/68-BWR DPCs, with approximately 13 MTU per DPC, would continue to do so through 2013.
- Plants with new ISFSIs would load high capacity DPCs (32-PWR or 61/68 BWR.
- From approximately 2014 forward, EPRI assumed that all CSNF would be loaded into higher capacity DPCs at existing ISFSIs and new ISFSIs (except at those sites currently loading CSNF into metal dual-purpose casks as noted in the first bullet, above).

As shown in Table A-2, EPRI estimates that utilities could load as many as 2,155 DPCs at reactor sites through 2020. Utilities have also loaded 220 canister-based storage-only dry storage systems – the YMSEIS assumes that some of these canisters would be transported to the repository for repackaging at the repository. Thus, EPRI estimates that as many as 2,375 DPCs and canister based systems could in use for storage of CSNF by 2020.

EPRI also projects that as many as 135 dual-purpose metal casks could be in storage at reactor sites by 2020. In addition, approximately 101 metal dry storage casks or other storage-only systems have been loaded for dry storage at reactor sites.

Table A - 2
Estimated Dry Storage Systems Loaded at Nuclear Power Plant Sites Through 2020

Package Type	Number of Packages Loaded
Storage-Only Canister Systems	220
Dual-Purpose Canister Systems	2,155
Dual-Purpose Metal Casks	135
Storage Only Metal Casks	101

Table A - 3
Estimated Number of DPCs (and Other Non-TAD Canisters) for Receipt at Yucca Mountain

Estimate	Number of DPCs for Receipt at Yucca Mountain
YM SEIS baseline	307
YM SEIS high DPC	966
EPRI	2375

A.3 Projections for Quantities of TAD Canisters Loaded at Reactor Sites and Yucca Mountain

The YMSEIS assumed that a total of 7,400 TADs would be used for CSNF disposal under the proposed action (DOE 2008a, Table 4-32). As noted in Appendix A.1, the YMSEIS assumes that a total of 6,499 TADs are loaded with CSNF at reactor sites, leaving a total of 901 TADs to be loaded with commercial SNF that is shipped in the 307 DPCs and 2,650 truck casks. Under EPRI Case 1, a total of 4,591 higher capacity TADs are assumed to be loaded at nuclear power plant sites. If the CSNF shipped to the repository in DPCs and truck casks are repackaged at the repository into higher capacity TAD packages (32P, 68B), EPRI estimates that 489 packages would need to be loaded at the repository. Under EPRI Case 2, a total of 4,928 higher capacity TADs are assumed to be loaded at reactor sites. Under this scenario, there were two truck casks containing CSNF, which is assumed to be transferred to a single TAD canister at the repository.

Table A - 4
Estimated Number of TADs Loaded at Reactors Versus Repository for Different Scenarios

Scenario	Number of TADs		
	Loaded at Reactor Sites	Loaded at Yucca Mountain	Total
DOE YMSEIS (70,000 MTU)	6,499	901	7400
EPRI Case 1	4,591	489	5080
EPRI Case 2	4,928	1	4929

A.4 References

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DOE 2008b. Final Supplemental 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, DOE/EIS-0250F-S1, LSN #: DEN001593669.

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B
RADIOLOGICAL IMPACTS

B.1 Radiological Impacts at Reactor Sites

Radiological impacts at reactor sites include worker doses associated with canister/cask loading, unloading, and handling activities as well as doses associated with ISFSI operations and maintenance, surveillance activities and additional ISFSI construction as discussed in more detail below.

B.1.1 Radiological Impacts Associated with Cask Loading and Handling

The YMSEIS assumed that workers at commercial nuclear power plant sites would incur radiological risk associated with the loading and handling of packages for transport of SNF as summarized in Table B-1. DOE's estimated worker doses at nuclear power plants included the following:

- 400 person-mrem per large capacity rail cask loaded and transferred to dry storage (this applies to TADs, DPCs, or bare-fuel rail casks) (DOE 2008a, Table G-2)
- 432 person-mrem per truck cask loaded (DOE 2008a, Table G-2)
- 663 person-mrem per package transferred from dry storage to rail cask. The YMSEIS assumed that all TADs loaded would be transferred to dry storage at reactor sites prior to transport by rail to Yucca Mountain. (DOE 2008a Table G-2; DOE 2008b,Transportation File, Attachment_02_Loading, loading_impacts.xls, CI_summary_rad worksheet).

Table B - 1
Doses to Workers At Reactor Sites Associated with Cask Loading and Handling Operations

Activity	Worker Dose (person-mrem/cask)
Canister/Cask Loading Operations	
▪ TADs or large rail casks	▪ 400
▪ Truck Casks	▪ 432
Cask Transfer from ISFSI to Rail Cask	
▪ DPC	▪ 663
▪ TAD	▪ 663
Cask Unloading Operations	
▪ Storage Only Systems	▪ 260
▪ DPC and Dual Purpose Casks	▪ 260

In the Proposed Action in the YMSEIS, DOE did not calculate the impacts associated with unloading storage-only dry storage systems or DPCs used for on-site for repackaging into TAD canisters, rail casks, or truck casks. The YMSEIS assumed that no DPCs or storage-only systems would be unloaded during the Proposed Action. If DPCs or storage-only systems needed to be unloaded, one could estimate the dose by using the same worker dose estimates that the YMSEIS used for unloading DPCs at the repository surface facilities. The YMSEIS

estimated that the radiological dose associated with unloading DPCs at the Yucca Mountain repository's Wet Handling Facility would be nominally 260 person-mrem per cask (assuming a collective dose of 13 person-rem/year and 50 casks per year at the Wet Handling Facility). (DOE 2008b, Radiological Health and Safety File, Attachment 1, Worker Tables_D9_D10).

As shown in Table B-2, utilizing the worker dose assumptions for cask loading and handling operations identified in Table B-1, EPRI calculated the impact associated with DOE's decision to utilize the 21P/44B TAD canisters for transport of CSNF to Yucca Mountain rather than utilizing large capacity TADs or DPCs. Table A-1 describes the number of packages assumed for the doses calculated in Table B-2. Compared to ERPI Case 1 assumptions in which larger capacity TADs are loaded at reactor sites for transport to Yucca Mountain, DOE's decision to utilize the 21P/44B TAD design rather than a large capacity TAD would increase worker doses associated with cask loading operations by 2,028 person-rem over the 24 years associated with transport of CSNF to the repository. Compared to EPRI Case 2 assumptions in which larger capacity TADs are loaded and a minimal number of truck casks are assumed for transport of CSNF currently stored at national laboratories, DOE's decision to utilize the 21P/44B TAD design and to ship CSNF from reactor sites using truck casks rather than large capacity rail casks would increase worker doses associated with cask loading operations by 2,813 person-rem over the 24 years associated with transport of CSNF to the repository.

Table B - 2
Estimated Worker Dose Associated with Cask Loading and Handling

	Total Worker Dose Associated with Cask Loading and Handling (person-rem)		
Package Type	**DOE YMSEIS**	**EPRI Case 1**	**EPRI Case 2**
TAD 21P/44B	6,908	0	0
Large Capacity TAD 24P/32P,61B,68B	0	4,880	5,238
DPC	203	203	203
Truck	1,145	1145	2
Total Worker Dose	8,256	6,228	5,443
% Dose Reduction		25%	34%

B.1.2 Radiological Impacts Associated with ISFSI Operation and Maintenance

As shown in Table B-3, below, in addition to the worker dose associated with loading and handling of packages for transport, the YMSEIS assumed that workers would incur the following doses associated with the dry storage of CSNF at 75 reactor sites for 20 years:

- 120 person-mrem per site per year for annual inspection/security surveillance (DOE 2008b, Transportation File, Attachment_02_Loading, loading_impacts.xls, CI_summary_rad worksheet)

- 1,500 person-mrem per site per year for annual maintenance (DOE 2008b, Transportation File, Attachment_02_Loading, loading_impacts.xls, CI_summary_rad worksheet)

B.1.3 Radiological Impacts Associated with ISFSI Expansion and Construction

While the YMSEIS and its associated calculational package did not calculate the additional radiological risk associated with additional construction at reactor site Independent Spent Fuel Storage Facilities (ISFSI), documentation associated with DOE's No Action Alternative did evaluate these impacts. If additional ISFSI construction is required while there is already CSNF in dry storage, DOE's No Action Alternative assumed that there would be an additional 170 person-mrem per additional cask loaded as shown in Table B-3. (Jason 1999, Rollins 1998).

Table B - 3
Doses to Workers at Reactor Sites Associated with ISFSI Operations, Maintenance and Construction

Activity	Unit Impact
ISFSI Operation and Maintenance (person-mrem per year per site)	
Inspection and security surveillance	120
Annual maintenance	1,500
Additional ISFSI Construction (person-mrem per additional canister stored)	170

B.1.4 Radiological Impacts Associated with Cask Unloading at Reactor Sites

As noted above, the Proposed Action in the YMSEIS does not calculate any impacts associated with unloading storage-only dry storage systems or DPCs used for on-site for repackaging into TAD canisters, rail casks, or truck casks. The YMSIES assumed that no DPCs or storage-only systems would be unloaded at reactor sites during the Proposed Action.

Accordingly, the YMSEIS does not calculate the worker dose associated with unloading CSNF in dry storage at reactor sites for repackaging prior to shipment to Yucca Mountain. However, it is conceivable that at point in the future, some of these packages would need to be unloaded at reactor sites for transfer into TADs. Should this activity become necessary EPRI calculates that industry workers would incur a dose of 260 person-mrem per package unloaded.

Table B-4 summarizes the potential worker dose associated with unloading, at reactor sites, the dry storage packages identified in Table A-2. The YMSEIS does not address CSNF stored in dual-purpose metal casks or storage-only metal casks in terms of transport or repackaging. For this inventory, EPRI estimated a cumulative worker dose of 35 person-rem associated with unloading dual-purpose metal casks and 26 person-rem associated with unloading storage-only metal casks at reactor sites for repackaging prior to transport to the repository. As noted earlier, the YMSEIS assumes that 307 to 966 DPCs and/or storage-only canister systems will be

transported to the repository for repackaging under the Proposed Action 70,000 MTU repository scenario and the Model 1 repository scenario, respectively. EPRI estimates that as many as 2,375 DPCs and storage-only canisters could be in use at reactor sites by 2020.

Table B - 4
Estimated Worker Dose Associated with Unloading Dry Storage Systems at Nuclear Power Plant Sites

Package Type	Number of Packages Unloaded	Estimated Worker Dose Unloading Operations (person-rem)
Storage-Only Canister Systems	220	57
Dual-Purpose Canister (DPC) Systems	2,155	560
Dual-Purpose Metal Casks	135	35
Storage Only Metal Casks	101	26

Although not considered by DOE as part of the LA, if these systems had to be unloaded at reactor sites for repackaging prior to transport, EPRI estimates a worker dose of 57 person-rem and 560 person-rem for unloading storage-only canister systems and DPCs, respectively.

B.2 Radiological Impacts to Workers During Incident-Free Transport

The YMSEIS estimates the impacts for maximally exposed workers associated for incident free transport of SNF and HLW to the repository. (DOE 2008a, Table 6-5). Shipment escorts and inspectors were assumed to receive the highest radiation doses due to their proximity to the casks. The YMSEIS made the following assumptions regarding incident free worker dose:

- Escorts, rail inspectors 0.5 rem per year
- Rail yard crew member 0.1 rem per year
- Truck driver 0.5 rem per year
- Truck inspector 0.2 rem per year

In order to calculate the collective incident free transportation impacts to workers, the YMSEIS utilized unit risk factors to provide an estimate of the radiation doses from transport of one shipment or container of radioactive material over a unit distance of travel in a given population density zone. Unit risk factors can provide an estimate of the radiation dose from one container or shipment being stopped at a location such as a rail yard or the radiation dose from one container or shipment passing a train stopped at a siding. The unit risk factors were combined with the cask, shipment, population density, and distance data to calculate collective dose. Unit Risk Factors for workers, used to calculate worker collective dose, are identified below.

Worker Unit Risk Factors – Incident Free Transportation, CSNF (DOE 2008b, Transportation File)

- Workers at stops
  - Enroute 6.03×10^{-6} person-rem/km
  - Near generator sites: 1.87×10^{-2} person-rem
- Workers during train assembly: 2.74×10^{-2} person-rem
- Security escorts
  - Rural: 2.02×10^{-5} person-rem/km
  - Suburban 3.23×10^{-5} person-rem/km
  - Urban 5.39×10^{-5} person-rem/km
- Security escorts:
  - At stops enroute: 9.36×10^{-6} person-rem/km
  - At stops near generator sites: 2.60×10^{-3} person-rem

As shown in Table B-5, the YMSEIS calculated the collective radiological impacts to transportation workers associated with incident free transportation of CSNF to the repository. (DOE 2008a, Table 6-4). The YMSEIS calculated a 2,833 total rail shipments (assuming three casks per train) for CSNF, DOE and Navy SNF, and HLW; and 2,650 truck shipments. As summarized in Table B-5, under EPRI Case 1 there would be an estimated 2,074 rail shipments, assuming three casks per train, and 2,650 truck shipments. Under EPRI Case 2 there would be an estimated 2,186 rail shipments (assuming 3 casks per train) and 2 truck shipments. The estimated rail shipments in the DOE YMSEIS, EPRI Case 1 and EPRI Case 2 include shipments of CSNF, DOE and Navy SNF, and DOE HLW.

The YMSEIS estimated the collective incident free radiation dose to workers associated with the transport of SNF and HLW by rail was 4,700 person-rem and by truck was 880 person-rem. For 2,833 rail shipments the average is 1.7 person-rem per rail shipment. For 2,650 truck shipments, the average dose per shipment is 0.3 person-rem.

As shown in Table B-5, if rail shipments of CSNF utilized higher capacity casks than the 21P/44B TAD design as assumed in EPRI Case 1, the estimated worker dose would be 4,326 person-rem – *a reduction of 1,174 person-rem compared to the worker dose calculated in the YMSEIS*. If rail shipments of CSNF utilized higher capacity TADs and the truck sites identified in the YMSEIS instead shipped by higher capacity TADs, the estimated worker dose would be 3,717 person-rem – *a reduction of 1,783 person-rem compared to the worker dose calculated in the YMSEIS*.

Table B - 5
Estimated Worker Dose Associated with Transport of SNF to Yucca Mountain

Scenario	Number of Shipments	Estimated Worker Dose (person-rem)
DOE YMSEIS (70,000 MTU)		
▪ **Rail Shipments (3 casks per train)**	2,833	4,700
▪ **Truck Shipments**	2,650	800
EPRI Case 1		
▪ **Rail Shipments (3 casks per train)**	2,074	3,526
▪ **Truck Shipments**	2,650	800
EPRI Case 2		
▪ **Rail Shipments (3 casks per train)**	2186	3,716
▪ **Truck Shipments**	4	1

B.3 Radiological Impacts to Workers at Yucca Mountain

B.3.1 Radiological Impacts Associated with Receipt, Handling, and Aging of CSNF

The YMSEIS assumed that workers at the Yucca Mountain repository would incur radiological risk associated with the receipt, handling, aging and permanent disposal operations. As shown in Table B-6, the YMSEIS included surface facility dose rates for each of the surface facility operations.

Table B - 6
Estimated Worker Dose Associated with Unloading Dry Storage Systems at Yucca Mountain Surface Facilities

Facility	Waste Type	Nominal Number Casks per Year	Annual Dose (Person-Rem)	Dose per Cask (Person-mrem/Cask)
Cask Receipt Security Station	***All Packages***	365	10	27
Receipt Facility	***All Packages***	210	36	172
Canister Receipt and Closure Facilities	***TAD, DOE SNF, DOE HLW***	216	27	125
Wet Handling Facility	***Bare CSNF and DPC***	50	13	260
Aging Facility	***DPC and TAD***	135	6	44

As shown in Table B-7, utilizing the worker dose assumptions for the receipt facilities identified in Table B-6 and the number of packages handled summarized in Table A-1, EPRI calculated the worker dose impacts associated with handling CSNF at the Yucca Mountain suface facilities.. Compared to ERPI Case 1 assumptions in which larger capacity TADs are loaded at reactor sites for transport to Yucca Mountain, DOE's decision to utilize the 21P/44B TAD design rather than a large capacity TAD would increase worker doses associated with cask handling operations at the Yucca Mountain surface facilities by 701 person-rem over the 24-years of the Proposed Action. Compared to EPRI Case 2 assumptions in which larger capacity TADs are loaded and a minimal number of truck casks are assumed for transport of CSNF currently stored at national laboratories, DOE's decision to utilize the 21P/44B TAD design and to ship CSNF from reactor sites using truck casks rather than large capacity rail casks would increase worker doses associated with cask handling operations at the Yucca Mountain surface facilities by 1,792 person-rem over the 24 years associated with the Proposed Action.

Table B - 7
Estimated Worker Dose Associated with Handling CSNF at Yucca Mountain

Facility	DOE YMSEIS		EPRI – Case 1		EPRI – Case 2	
	Number Packages	Worker Dose (Person-Rem)	Number Packages	Worker Dose (Person-Rem)	Number Packages	Worker Dose (Person-Rem)
Cask Receipt Security Station	9456	255	7548	204	5239	141
Receipt Facility	9456	1,626	7548	1,298	5239	901
Canister Receipt & Closure Facilities						
TAD	6499	812	4591	574	4928	616
Wet Handling Facility						
DPC	307	80	307	80	307	80
Truck	2,650	689	2,650	689	4	1
Aging Facility						
TAD	6499	286	4591	202	4928	217
DPC	307	14	307	14	307	14
TOTAL DOSE		3,762		3,061		1,970

B.3.2 Radiological Impacts to Workers at Yucca Mountain Associated with Unloading Additional Dual-Purpose Canisters

As discussed in Section A.2, the YMSEIS assumes that 307 to 966 DPCs and/or storage-only canister systems will be transported to the repository for repackaging under the 70,000 MTU repository scenario and the full MTU scenario, respectively. EPRI estimates that as many as

2,375 DPCs and storage-only canisters could be in use at reactor sites by 2020. EPRI contends that it is possible that some of these DPCs and storage-only canisters may be able to be placed in a waste package for direct disposal, without repackaging.

If these systems were transported to Yucca Mountain and unloaded, rather than being placed in waste packages for direct disposal, *a net additional worker dose of 135 person-mrem per package (260 person-rem – 125 person rem from Table B-6) would be incurred to unload the additional DPCs or disposal canisters* (Table B-8). Accordingly, this same dose also represents the potential dose avoided per canister if direct disposal of DPCs or other canisters were incorporated into DOE operations.

Table B - 8
Estimated Net Worker Dose Associated with Unloading DPCs (and Storage Only Canisters) at Yucca Mountain

Scenario	Number of DPCs for Receipt at Yucca Mountain	Worker Dose for DPC Unloading (person-rem)
YM SEIS	307	41
EPRI Case 1	966	130
EPRI Case 2	2375	320

B.3.3 Radiological Impacts Associated with Management of Empty DPCs as Low-Level Radioactive Waste

Every DPC canister unloaded (for transfer of CSNF inventory to TAD) will generate a significant quantity of low-level radioactive waste (LLW) that needs to managed and disposed of safely, incurring additional doses and non-radiological risks to workers at the point of fuel transfer (utility or Yucca Mountain receipt facility). DOE assumes each DPC represents 10.6 m^3 in LLW volume (DOE, 2008b, waste file, June 2008, filename: CalcPkg_Waste1_Attach2_MG_9.19.07.xls.) For the proposed action in the YMSEIS, DOE explicitly considers 307 DPCs for receipt at Yucca Mountain, which would need disposal as LLW once the CSNF inventories were transferred to TADs. The corresponding volume of LLW from DPC disposal in this case would be 3,254 m^3 or 4% of the total projected LLRW volume of 74,000 m^3 (Table 4-31, DOE, 2008a) to be processed for the project. However, in the YMSEIS, DOE also provides an upper bound estimate on DPC derived LLRW based on the ultimate disposal of 920 DPCs, which correspond to a total volume of 9,800 m^3 (DOE, 2008a) or 13% of total LLW volume for the pre-closure period of the project.

DOE estimates that LLW facility operations will result in worker doses of 9 person-rem per year (DOE, 2008b waste file, June 2008, Rad H&S File, Attachment 1, Worker Tables). In the absence of more specific information such as activity of individual waste streams, it is difficult to attribute dose to DPCs. For simplicity, EPRI assumes that doses from the management of DPC wastes are proportional to waste volumes. Accordingly, a 4 – 13% DPC waste volume range would yield 0.36 – 1.2 person-rem/year dose to workers from DPC waste management activities. Collective worker dose associated with the Low-Level Waste Facility during the operations

period are estimated by DOE to be 310 person-rem (Table D-9; DOE 2008a, Vol II., Appendix D, p. D-22). For a total LLW volume of 74,000 m3, this corresponds to 4.2 x 10^{-3} person-rem/m^3.

EPRI has independently calculated that there could be as many as 2,375 DPCs and other non-TAD canister-based systems loaded for storage of CSNF at reactor sites. If these DPCs are unloaded at Yucca Mountain for transfer of CSNF to TAD canisters, there will be corresponding increases in the volume of LLW requiring disposal and worker dose. Assuming a LLW volume of 10.6 m^3 for each DPC discarded, the corresponding volume of LLW would be 25,175 m^3, a 15,375 m^3 increase over the DPC volume assumed in the YMSEIS (DOE, 2008a). Using the 4.2 x 10^{-3} person-rem/m^3 unit dose calculated above, disposal of one DPC yields a unit dose of 0.045 person-rem. Likewise, disposal of a total of 2,375 DPCs would result in additional collective worker doses of 65 person-rem over the operations phase of the project. Disposal of the empty DPCs offsite along with other LLW would impose radiological risks to workers at commercial facilities. Relevant occupational doses associated with commercial low-level radioactive waste management are reported by NRC up through the year 1998 in NUREG-0713.[5] Worker doses of 0.1 rem/year appear representative for the most recent NRC data.

Table B - 9
Estimated Worker Dose Associated with Management of Empty DPCs (and Storage Only Canisters) as Low-Level Radioactive Waste

Scenario	Number of DPCs for Receipt at Yucca Mountain	Worker Dose for DPC Management as LLRW (person-rem)
YM SEIS (baseline)	307	14
YM SEIS High DPC Estimate	966	43
EPRI DPC Estimate	2375	110

The current DOE proposed approach does not call for unloading of DPCs at generator sites; however, it in conceivable that such a burden could be shifted to utilities and other ISFSI operators. Any LLW management activities resulting from the unloading of DPCs at the plant site would result in comparable (non-trivial) doses to workers at the generator end of the supply chain.

B.3.4 Radiological Impacts Associated with Additional Subsurface Construction Resulting from the Exclusive Use of Low Capacity TAD Canisters for CSNF

DOE's decision to use relatively low capacity 21P/44B TAD canisters will require the excavation of more emplacement drifts and associated access drifts than if higher capacity TADs and/or DPCs were accommodated in the proposed action. Accordingly, each additional,

[5] After 1998, all operating LLW facilities were located in NRC Agreement States and no longer reported annual dose numbers to the NRC.

unnecessary meter of drift that needs to be excavated and developed results in addition, unnecessary radiological risk to workers due to external and internal exposure from natural radioactivity and external exposure due to man-made radioactivity once emplacement of waste packages begins.

DOE envisions subsurface construction activities, including drift excavation and development, to occur over the initial 5 year construction phase and extending into the first 22 years of the operations phase of the repository.

Collective dose to workers is calculated on a unit (per meter) basis for drift excavation by summing collective doses over the construction phase and the first 22 years of the operations phase for involved subsurface craft workers and then dividing this dose by DOE's estimated total drift length (67,915 m) as discussed further in Appendix D. Involved subsurface collective dose for the construction period is estimated by DOE to be 33 person-rem (DOE 2008a,, Table 4-23, Vol. I, Ch. 4, pg. 4-66).

Total collective dose to involved workers during the operations phase is estimated by DOE to be 4,200 person-rem. The collective dose to involved subsurface craft workers is calculated by multiplying this total by the ratio of involved subsurface craft FTEs during operations (4339) to total involved staff FTEs during operations (23,399) (DOE, 2008b, non-rad H&S folder; filename: CAlcPkg_HS1_Attch1_JLS_09-04-07.xls). The resulting collective dose to involved subsurface craft workers during operations is 779 person-rem.

Based on the above calculations, EPRI estimates that the total dose to involved subsurface craft works would be 812 person-rem. The resulting dose on a per meter basis is then 0.012 person-rem/m or 0.067 person-rem/waste package (assuming 5.6 m per average waste package). As discussed in Appendix A.3, a total of 7400 CSNF waste packages would be disposed of using DOE's assumed 21P/44B TAD for CSNF. Under EPRI Case 1, a total of 5,080 larger capacity TADs would be disposed – 2,320 less than assumed in the YMSEIS. This results in a reduction in worker dose associated with subsurface operations of 155 person-rem. Under EPRI Case 2, a total of 5,929 larger capacity TAD waste packages would be disposed – a 2,471 reduction in waste packages. This results in a reduction of worker dose associated with subsurface operations of 166 person rem.

B.3.5 Radiological Impacts Associated with Drip Shield Installation

The YMSEIS assumes that the annual individual dose associated with installation of the drip shields is 9.75 mrem per year, with a staffing of 10 persons per year, resulting in a total dose of 97.5 person-mrem per year. The repository closure phase is assumed to last for 10 years, although it is not clear from the YMSEIS whether the drip shield installation operations will take place during the entire 10-year operations-closure phase. If drip shield installation takes five years, the total dose would be 487.5 person-mrem. If it takes ten years, the total dose for drip shield installation would be 975 person-mrem. (BSC 2007)

B.4 Radiological Impacts Associated with A One-Year Delay of CSNF Shipment to Yucca Mountain

While the YMSEIS and its associated calculational package did not calculate the additional radiological risk associated with additional construction at reactor site Independent Spent Fuel

Storage Installations (ISFSIs), documentation associated with DOE's No Action Alternative did evaluate these impacts. If additional ISFSI construction is required while there is already CSNF in dry storage, DOE's No Action Alternative assumed that there would be an additional 170 person-mrem per additional cask loaded (Jason 1999, Rollins 1998). In addition, as noted in Table A-4 above, ISFSI operation and maintenance was estimated to incur additional worker radiation exposure of:

- 120 person-mrem per year per site surveillance
- 1,500 person-mrem per year per site for annual maintenance

The YMSEIS assumes that there are 75 commercial reactor sites. If nuclear operating companies are discharging 2,200 MTU of CSNF from plants on an annual basis, this would require between 160 and 220 dry storage systems per year for additional on-site storage (assuming between 10 and 14 MTU per system). Thus, assuming that each reactor site would have an operational ISFSI by the 2020 time period, this results in the following industry wide impacts:

- 9 person-rem per year for ISFSI surveillance activities
- 112.5 person-rem per year for ISFSI annual maintenance
- 27 to 37 person-rem per year for additional ISFSI construction (170 person-mrem per cask loaded).

B.5 References

BSC 2007. Subsurface Worker Dose Assessment, Document ID 800-ooc-SS99-00600-000-00A, ENG.20070626.0020, June 2007.

DOE 2008a. Final Supplemental 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, DOE/EIS-0250F-S1, LSN #: DEN001593669.

DOE 2008b. Yucca Mountain Supplemental Environmental Impact Statement: Calculation Packages in Support of Final Supplemental 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, DOE/EIS-0250F-S1.

Jason 1999. Health and Safety Impacts during Controlled Long Term Storage of SNF and HLW in the U.S., Jason Technologies, April 1999, LSN #: DN2001094424.

Rollins 1998. Radiological Impacts for Scenario 1 at Commercial Nuclear Power Plants, Rollins, Tetra Tech NUS, October 1998, LSN #: DN2001483535

C
NON-RADIOLOGICAL WORKER IMPACTS

C.1 Non-Radiological Impacts at Reactor Sites

DOE considers non-radiological or industrial safety impacts to industry workers associated with CSNF storage at reactor sites and transport to Yucca Mountain, applying Bureau of Labor Statistics occupational hazard data from 2005 for total reportable cases (TRC) per 100 employees, lost workday cases (LWC) per 100 employees, and fatalities per 100,000 employees. Accordingly, EPRI utilized 2005 BLS data for consistency (BLS 2006a,b) Table C-1 provides data for relevant occupations.

Table C - 1
Occupational Injury and Fatality Rate Data for Relevant Occupational Categories in 2005 (BLS 2006a,b)

Category	NAICS code	TRC(per 100 FTE)	LWC (per 100 FTE)	Fatalities (per 100,000 FTE)
Construction	23	6.3	3.4	11.0
Warehousing and storage	493	8.2	5.4	17.6[a]
Truck transportation	483	6.1	3.9	17.6[a]
Rail transportation	482	6.0	4.5	17.6[a]
Utilities	22	4.6	2.4	3.6
Mining	21	3.6	2.2	25.6

[a]Fatalities for transportation and warehousing category, NAICS code 48-49

Fatality rates for specific high risk occupations that are relevant for Yucca Mountain construction and operation are also presented for illustration purposes in Table C-2..

Table C - 2
Selected Occupations with High Fatality Rates for 2005 (BLS 2006a,b)

	Fatalities (per 100,000)
Structural iron and steel workers	55.6
Driver/sales workers and truck drivers	29.1
Construction laborers	22.7

C.1.1 Non-Radiological Impacts Associated with Cask Loading and Handling

Loading and handling of canisters and cask systems represent is one of the key contributors to worker risk and is subject to substantial changes based on how and when DOE operates a repository. For the purposes of this report, EPRI estimates occupational impacts from

canister/cask loading and handling operations in two ways. The first approach assumes a representative output of canisters on an annual basis and yields calculated hazards based on estimated person-hours required for that activity. The second approach evaluates the differential impact of DOE's decision to adopt a standardized TAD canister for CSNF with a 21 PWR/44 BWR fuel element capacity.

For the first approach, EPRI assumes that loading and handling of one canister/cask system requires 400 person-hours (0.20 FTE). This assumption is based on estimates for loading, on site transport, and emplacement of a TN-32 horizontal cask system (Dominion, 2002). Applying Bureau of Labor Statistics data for warehousing and storage occupations, this translates into the following non-radiological impacts for each canister/cask loaded at reactor sites:

- TRC = 0.016
- LWC = 0.011
- Fatalities = 0.000035

For the second approach, EPRI adopted the approach used by DOE in its Final SEIS (DOE 2008a). According to the YMSEIS, the analysis of industrial safety impacts was based on an average loading duration of 2.3 days per rail cask for PWR SNF and 2.5 days per rail cask for BWR SNF. DOE's analysis assumed truck cask loading times of 1.3 days per cask for PWR SNF and 1.4 days per cask for BWR SNF. (DOE 2008a, Section G.1.3). A total of 1,347 worker-years would be spent on loading activities for involved workers. DOE also calculated non-involved worker impacts, assuming that the non-involved workforce would be 25% of the involved workforce.

According the YMSEIS, DOE based incidence and fatality rates on Bureau of Labor Statistics (BLS) data for 2005 (BLS 2006a,b), referencing the data for workers in the transportation and warehousing industries to estimate impacts associated with loading SNF casks. The following assumptions were used to calculate worker impacts associated with loading TAD canisters with CSNF:

- 8.2 TRC per 100 FTE for Involved Workers (warehousing and storage, 2005)
- 5.4 LWC per 100 FTE for Involved Workers (warehousing and storage, 2005)
- 17.6 Fatalities per 100,000 workers for Involved Workers (transportation and warehousing, 2005) (DOE 2008a, Table G-3)

Utilizing the above assumptions, DOE calculated industrial safety impacts to involved workers as summarized in Table C-3. Impacts included 110 total recordable cases (TRC); 73 lost workday cases (LWC) and 0.24 industrial fatalities for loading activities for CSNF, DOE SNF, DOE HLW, and Naval SNF. Assuming changes in the number of CSNF packages loaded, consistent with ERPI Case 1 and EPRI Case 2, EPRI recalculated the industrial safety impacts in order to quantify the increase in the impacts associated with DOE's selection of a 21P/44B TAD rather than a higher capacity TAD design similar in capacity to DPCs being loaded at reactor sites.

Table C - 3
Estimated Industrial Safety Impacts to Involved Workers During Loading Operations

Impact Type	Impact		
	DOE YMSEIS	EPRI Case 1	EPRI Case 2
Total recordable cases	110	91	79
Lost workday cases	73	60	52
Industrial Fatalities	0.24	0.20	0.17

As shown in Table C-3, DOE's selection of a 21P/44B TAD rather than a higher capacity TAD design similar in capacity to DPCs being loaded at reactor sites today results in the following increased health and safety impacts to involved workers:

- 19 TRC
- 13 LWC
- 0.04 industrial fatalities

DOE's selection of a 21P/44B TAD rather than a higher capacity TAD and its assumption that seven commercial nuclear power plant sites would ship CSNF to Yucca Mountain using truck casks rather than DPCs or large capacity TADs results in 4,217 additional packages being loaded at reactor sites. This results in the following increased health and safety impacts to involved workers:

- 31 TRC
- 21 LWC
- 0.07 industrial fatalities

C.1.2 Non-Radiological Impacts Associated with ISFSI Operation and Maintenance

As part of its occupational health and safety calculations, DOE in its YMSEIS used the following assumptions for ISFSI operation and maintenance.

- Total inspection/security surveillance: 30 person-hours per year (0.015 FTE)
- Total maintenance: 30 person-hours per year (0.015 FTE)
- Total for ISFSI operational and maintenance: 60 person-hours per year (0.030 FTE)

Using the Bureau of Labor Statistics injury and fatality rates for the utility occupational category (NAICS code 22) yields the following projected annual impacts at each ISFSI site for surveillance/inspection:

- TRC 0.00069
- LWC 0.00036
- Fatalities 5.4×10^{-7}

Likewise, annual impacts at each ISFSI for routine maintenance are calcualated to be:

- TRC 0.00069
- LWC 0.00036
- Fatalities 5.4×10^{-7}

C.1.3 Non-Radiological Impacts Associated with ISFSI Expansion and Construction

Using BLS injury and fatality data for the construction industry and assuming that the estimated time associated with construction of one horizontal storage module is 1500 person-hrs (0.75 FTE) (Rollins, 1998), EPRI estimates the following non-radiological impacts associated with ISFSI expansion and construction of additional storage modules:

- TRC 0.047
- LWC 0.026
- Fatalities 0.000083

Assuming that the estimated time asociated with construction of an additional ISFSI storage pad is 7090 person-hrs (3.5 FTE) (Dominion, 2002), EPRI estimates the following non-radiological impacts associated with ISFSI expansion and construction of one additional ISFSI storage pad:

- TRC 22
- LWC 12
- Fatalities 0.00039

C.2 Non-Radiological Impacts to Workers During Transport

The YMSEIS idenfies the probablity of a rail transport accident to be 1.15 × 10-8 fatality/railcar-km (DIRS 178016-DOT 2005, all). For shipments involving 3 spent nuclear fuel casks (8 railcars total), the fatality rate was estimated to be9.20 × 10-8 accidents/train-km.

In the YMSEIS, the non-radiological fatality rate associated with rail accidents was estimated to be 1.15×10^{-8} fatality/railcar-km. For shipments involving three CSNF casks (8 railcars total), the fatality rate was estimated to be 9.20×10^{-8} accidents/train-km. Thus, a reduction in the number of cask shipments that results in a reduction in the number of train shipments would reduce the risk of transportation accidents and fatalities. (Source: DOE 2008b, p. 53)

The YMSIES identifes the probablity of truck transport accidents. Truck accident and fatality rates are state specific; however the average accident rates for trucks are:

- 5.34E-07 accidents per truck km

- 55E-08 fatalities per truck km

(Source: DOE 2008b, Attachment 8A Database)

C.3 Non-Radiological Impacts to Workers at Yucca Mountain

The YMSEIS estimated non-radiological health and safety impacts to workers at Yucca Mountain from industrial hazards using the Computerized Accident/Incident Reporting System (CAIRS) database. CAIRS is a DOE database that collects reports of injuries, illnesses, and accidents that occur at DOE sites. It records TRC and "days away, restricted or on job transfers", which is equivalent to the BLS LWC category. Table C-4 presents the non-radiological health and safety statistics used in the SEIS to calculate impacts to involved workers.

Table C - 4
DOE Occupational Injury and Fatality Data for Construction and Operations Periods from CAIRS Database

Project period	TRC	LWC	Fatalities	Source
Construction	2.0	0.86	0.55	DOE 2008a, Table 4-16), Section 4.1.7.1
Operations	1.4	0.58	0.55	DOE 2008a, Table 4-20, Section 4.1.7.1.2

The YMSEIS calculated the impacts to involved workers during construction, operation, monitoring and closure of the repository, as summarized in Table C-5. While the calculational packages that support the YMSEIS does contain a breakout of worker hours for each of the operational periods identified in Table C-5, EPRI was not able to identify the specific worker hours associated with handling of the TAD packages for receipt, waste package closure, aging and emplacement. Therefore, EPRI was not able to identify the increase in worker hours associated with DOE's decision to utilize a 21P/44B TAD package and rather and higher capacity TAD packages as described by EPRI Case 1. Similarly, EPRI was not able to identify the increase in worker hours associated with DOE's decision to utilize a 21P/44B TAD design and to ship CSNF using truck casks from seven commercial nuclear power plant sites.

EPRI has not quantified the additional industrial hazards to workers associated with the receipt and handling the 9,456 CSNF casks assumed in the DOE YMSEIS, rather than a total of 7,548 casks under EPRI Case 1 – a 20% reduction in the number of packages handled and emplaced. Similar, under EPRI Case 2, industrial hazards associated with handling 5,239 casks under EPRI Case 2 – more than a 40% reduction in packages handled – would be lower than the impacts associated with handling 9,456 CSNF casks as assumed by DOE.

Table C - 5
Impacts to Involved Workers During Construction, Operations, Monitoring and Closure Periods for a Yucca Mountain Repository

Impact Category/Operations Period	Impact
Construction	
▪ TRC	120
▪ LWD	50
▪ Fatalities	0.032
Operations – Surface Construction	
▪ TRC	53
▪ LWC	23
▪ Fatalities	0.015
Operations – Subsurface Construction	
▪ TRC	87
▪ LWC	37
▪ Fatalities	0.024
Operations – Emplacement Operations	
▪ TRC	160
▪ LWC	67
▪ Fatalities	0.064
Operations – Maintenance	
▪ TRC	68
▪ LWD	28
▪ Fatalities	0.027
Monitoring	
▪ TRC	320
▪ LWC	130
▪ Fatalities	0.31
Closure	
▪ TRC	320
▪ LWC	150
▪ Fatalities	0.15
Source: DOE 2008b, H&Snonrad File, Attachment 1	

C.3.1 Non-Radiological Impacts Associated with Receipt, Handling, and Aging of CSNF

Not estimated as a separate category. Refer to Section C.3 above.

C.3.2 Non-Radiological Impacts Associated with Unloading Additional Dual-Purpose Canisters

Not estimated as a separate category. Refer to Section C.3 above.

C.3.3 Non-Radiological Impacts Associated with Management of Empty DPCs as Low-Level Radioactive Waste

In terms of non-radiological hazards, the handling of empty DPCs will also incur non-trivial risks to workers due to the routine hazards of handling heavy materials. Each empty DPC can weigh on the order of 36,000 lbs to 58,000 lbs. For Yucca Mountain work, DOE uses occupational hazard figures derived from its own experience as documented agency's CAIRS database. For the operational phase, these occupation risk numbers are: 1.4 TRC per 100 FTEs, 0.58 LWC per 100 FTEs, and 0.55 fatalities per 100,000 FTEs. Disposal of the empty DPCs offsite would, likewise, impose non-radiological risks to workers at commercial facilities. For these workers, it would be appropriate to apply BLS data (from Section B.1):

- 8.2 total recordable cases (TRC) per 100 FTE for Involved Workers (warehousing and storage, 2005)
- 5.4 lost workday cases (LWC) per 100 FTE for Involved Workers (warehousing and storage, 2005)
- 17.6 Fatalities per 100,000 workers for Involved Workers (transportation and warehousing, 2005) (DOE 2008a, Table G-3)

The current DOE proposed approach does not call for unloading of DPCs at generator sites; however, it in conceivable that such a burden could be shifted to utilities and other ISFSI operators. Any LLRW management activities resulting from the unloading of DPCs at the plant site would present occupational risk to those involved workers.

C.3.4 Non-Radiological Impacts Associated with Additional Subsurface Construction Resulting from the Exclusive Use of Low Capacity TAD Canisters for CSNF

DOE's decision to use the 21P/44B TAD canisters rather than higher capacity TADs will require the excavation of more emplacement drifts and associated access drifts than if higher capacity TADs and/or DPCs were accommodated in the proposed action. Accordingly, each additional, unnecessary meter of drift that needs to be excavated and developed results in addition, unnecessary radiological risk to workers due to external and internal exposure from natural radioactivity and external exposure due to man-made radioactivity once emplacement of waste packages begins.

DOE proposes subsurface construction activities, including drift excavation and development, occurring over the initial 5 year construction phase and extending into the first 22 years of the operations phase of the repository.

EPRI calculated the non-radiological occupational risks associated with drift excavation on a unit (per meter) basis by summing the respective occupational health and safety categories (TRC, LWC, and fatalities) over the construction phase and operations phase for involved subsurface craft workers and then dividing by DOE's estimated total drift length (67,915 m). Occupational health and safety numbers for subsurface construction during the construction phase are calculated by applying the ratio of the subsurface craft FTEs (336) to the total FTEs (5,886) for the period (DOE 2008b, non-rad H&S folder; filename: CAlcPkg_HS1_Attch1_JLS_09-04-07.xls). As shown in Table C-6, EPRI calculated that the fraction of FTE associated with subsurface craft workers is 0.057. Table C-7 summarizes the worker health and safety impacts during the construction phase from the YMSEIS – with 117.2 TRC, 50.2 LWC, and 0.032 fatalities. Using the subsurface craft worker fraction calculated in Table C-6, EPRI estimated the worker impacts during the construction phase for subsurface workers – 6.69 TRC, 2.86 LWC, and 0.0018 fatalities. Occupational health and safety numbers are explicitly reported for subsurface construction during the operations phase, as shown in Table C-7. During the operations phase, subsurface construction results in occupational health and safety impacts of 87.08 TRC, 37.29 LWC, and 0.024 fatalities.

Table C - 6
FTE During Construction Phase (2012 – 2016)

	FTEs
Subsurface Craft FTE	335.75
Total FTE	5886
Subsurface Craft Fraction	0.057

Table C - 7
Estimated Worker Health and Safety Impacts During Construction and Operation

Construction Phase – Total Impacts	**Cases**
TRC	117.2
LWC	50.2
Fatalities	0.032
Construction phase – subsurface construction only (calculated)	**Cases**
TRC	6.69
LWC	2.86
Fatalities	0.0018
Operations phase - subsurface construction	Cases
TRC	87.08
LWC	37.29
Fatalities	0.024

Summing the non-radiological impacts associated with construction of subsurface facilities during the construction and operations phases, EPRI calculated impacts of 97.77 TRC, 40.14 LWC, and 0.026 fatalities as shown in Table C-8. Assuming that the total excavated drift length in the repository is 67,915 meters, EPRI calculated the number of worker impact cases per meter as shown in Table C-8. Assuming that each waste package occupies a drift length of

approximately 5.6 meters as discussed previously in Appendix B.7, EPRI estimates the number of worker impact cases per waste package emplaced.

Table C - 8
Unit Non-Radiological Occupational Risks Associated with Subsurface Construction

Worker Impacts	Cases	Cases per Emplacement Meter	Cases per Waste Package Emplaced
TRC	93.77	1.4×10^{-3}	7.7×10^{-3}
LWC	40.15	5.9×10^{-4}	3.3×10^{-3}
Fatalities	0.026	3.8×10^{-7}	2.1×10^{-6}

C.3.5 Non-Radiological Impacts Associated with Drip Shield Installation

The YMSEIS assumes a staffing level of 10 persons per year associated with drip shield installation. The repository closure phase is assumed to last for 10 years, although it is not clear from the YMSEIS whether the drip shield installation operations will take place during the entire 10-year operations-closure phase. On annual basis, then, non-radiological impacts to workers during drip shield installation are calculated as follows using DOE's industrial safety statistics for a 10 FTE workforce:

- TRC 0.82 per year
- LWC 0.54 per year
- Fatalities 0.0018 per year

Thus, over an assumed five year period for drip shield installation there would be 4.1 TRC, 2.7 LWC, and 0.009 fatalities. If drip shield installation takes place over a ten-year period, the estimated non-radiological worker impacts would be 8.2 TRC, 5.4 LWC, and 0.018 fatalities.

C.3.6. Non-Radiological Impacts Associated with Over-Design of Surface Facilities for Seismic Considerations

Due to the classification of facility details as "Official Use Only" resulting in their omission from the publicly available version of the License Application, EPRI attempted to evaluate the occupational consequences on a more generic, semi-quantitative level using a stylized approach based on the available dimensions for the WHF footprint, typical above-grade height, and wall thickness. EPRI assumed for the purpose of this illustration a WHF facility comprised solely of a rectangular concrete shell. As part of this approach, EPRI ignored the contributions from roof, base mat/pad, and interior walls. The data and assumptions are listed below:

- Dimensions from DOE , 2008 LA (DOE, 2008c; p. 1.2.5-3):
  - ITS footprint of waste handling facility = 385 ft. x 300 ft.
  - Typical height of facility above grade = 80 ft.
  - Exterior wall thickness = 4 ft.
- Conservative assumptions:
  - a simple four sided building shell with above dimensions
  - not considering contribution of internal walls (unknown)

- not considering contribution of base mat/foundation/pool structures (assume to be appropriate)
- not considering contribution of roof (unknown/assume to be appropriate)
- not considering shrinkage of concrete upon drying

- Other Assumptions
  - neglecting volume consumed by rebar, openings (more than offset by conservative simplification of building)
  - capacity of a typical ready mixed concrete truck = 20 cu yd. or 540 cu. ft. (Clark et al., 2001)

Using these assumptions and data, the resulting volumes are calculated:

- Total wall volume = 438400 cu. ft. = 812 truck loads
- Volume reduction for 10% reduction in wall thickness = 43840 cu. ft. = 81 truck loads
- Volume reduction for 25% reduction in wall thickness = 109600 cu. ft. = 203 truck loads

Any unnecessary and unjustified conservatism in the construction of WHF and other surface pre-closure facilities result in incremental increases in worker risk due to well-documented occupational hazards. In addition to the often repeated fact that the construction industry is a perennial leader in occupational injury and fatality rates, the Bureau of Labor Statistics has also singled out three specific occupations that exhibited exceptionally high fatality rates in 2005: structural iron and steel workers, truck drivers, and construction laborers.

Table C - 9
Selected Occupations with High Fatality Rates for 2005 (BLS, 2006a)

	Fatalities (per 100,000)
Structural iron and steel workers	55.6
Driver/sales workers and truck drivers	29.1
Construction laborers	22.7

The reinforcement of concrete structures to withstand seismic loads directly involves the contribution of all three of these high-risk occupations for the preparation of appropriate concrete forms, assembly of additional rebar, and pouring of additional concrete. Additional concrete also results in additional truck deliveries that could number in the 100's to 1000's for the case of an over-designed facility. Accordingly, the purposeful over-design (beyond standard engineering margins) for seismic or any other hazard represents unnecessary and unjustified imposition of risk to the involved workers.

Table C - 10
Relevant BLS[a] and DOE[b] Non-radiological Injury and Fatality Rates

Category	TRC	LWC	Fatalities
BLS - construction	6.3	3.4	11.0
BLS - warehousing and storage	8.2	5.4	17.6[c]
BLS - truck transportation	6.1	3.9	17.6[c]
DOE - construction period[b]	2.0	0.86	0.55

[a]BLS, 2006a,b
[b]DOE 2008a, Table 4-16), Section 4.1.7.1
[c]Fatalities for transportation and warehousing category, NAICS code 48-49

It should be noted that DOE's injury and fatality rates are substantially lower that reported by BLS. DOE does not differentiate between specific trades and occupations such as iron workers.

In addition to occupational consequences, the over-design of facilities also consumes significant quantities of materials and resources that would have beneficial uses elsewhere, especially in terms of concrete (cement and aggregate) and rebar (iron/steel).

C.4 Non-Radiological Impacts Associated with a One-Year Delay of CSNF Shipment to Yucca Mountain

The major consequence of a delay in Yucca Mountain becoming operational is that existing inventories of CSNF will remain for a longer period of time at reactor sites and other commercial facilities and additional quantities of CSNF will need to be stored in both wet and dry storage. These burdens result in additional occupational health risk to workers at reactor storage sites (and other commercial facilities) associated with fuel, canister, and cask handling operations, onsite transport and emplacement operations, routine surveillance and maintenance activities, and construction of additional storage capacity. For this report, EPRI focused on the ISFSI related activities.

The YMSEIS assumes that there are 75 commercial reactor sites. Accordingly, EPRI estimates the industry wide non-radiological impacts of a one-year delay of CSNF shipments to Yucca Mountain by extrapolating the impacts described in Sections C.1.2 and C.1.3 of this Appendix for ISFSI operation and expansion, respectively, to the SEIS inventory of 75 reactor sites, assuming that each reactor site would have an operational ISFSI by the 2020 time period. These results are summarized in Table C-11.

Table C - 11
Industry Wide Non-Radiological Impacts Associated with a One-Year Delay

Activity	Annual Injuries and Fatalities (cases)
ISFSI Surveillance and inspection	0.052 TRC 0.027 LWC 4.1×10^{-5} fatalities
ISFSI Maintenance	0.052 TRC 0.027 LWC 4.1×10^{-5} fatalities
Additional storage module construction at existing ISFSI[a]	7.5 – 10 TRC 4.2 – 5.7 LWC 0.013 – 0.0189 Fatalities
ISFSI pad construction[b]	22 TRC 12 LWC 3.9 x 10-4 fatalities

[a]Based on TN-32 horizontal storage module (Rollins, 1998) and annual requirement of 160 – 200 dry storage systems for 75 commercial reactor sites.

Additionally, in the event that either existing ISFSI pad capacity at a particular site is full or does not exist, the construction of a new pad could become necessary. Table C-12 includes the non-recurring occupational consequences associated with the construction of one ISFSI pad from Section C.1.3.

Table C - 12
Non-Radiological Impacts Associated with a the Need to Construct One Additional ISFSI Pad

Activity	Total Injuries and Fatalities (cases)
ISFSI pad construction[b]	22 TRC 12 LWC 3.9 x 10-4 fatalities

[b]Based on 7090 person-hours estimate for construction of one ISFSI pad for storage of up to 28 TN-32 horizontal storage modules (Dominion, 2002).

C.5 References

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D
REPOSITORY SUBSURFACE EXCAVATION

The EPRI analysis presented in this report relies upon assumptions, estimates, and specifications pertaining to subsurface excavation and construction. For clarity, these are summarized below.

Projected Repository Subsurface Construction Requirements (DOE, 2008):

- Total drift length = 67,915 m
- Total drift length for emplacement of WPs = 65,209 m
- Drift diameter = 5.5 m
- Average/typical emplacement drift length = 600 m
- Approx. number of emplacement drifts = 108 in 4 panels
- Total volume of excavated rock = 6.5×10^6 m^3
- Volume of excavated rock for emplacement of WPs = 6.2×10^6 m^3
- Average length for 1 WP = 5.6 m
- Volume of excavated rock per meter of drift = 24 m^3
- Volume of excavated rock per average waste package = 133 m^3

Excavation volumes calculated assuming cylindrical geometry

- Total number of waste packages for emplacement (in TSPA) = 11,629
- Total number of TADs for emplacement = 7,400

Reference

DOE 2008. Yucca Mountain Repository License Application. U.S. Department of Energy, Office of Civilian Radioactive Waste Management, DOE/RW-0573, Rev. 0, June 2008.

E
MATERIALS AND IMPACTS ASSOCIATED WITH KEY REPOSITORY SYSTEMS

Overly conservative design and certain operational decisions will result in the consumption of materials and manufacture and shipping of additional heavy components to either utility sites or Yucca Mountain, incurring non-trivial risks to workers as well as the public.

Overdesign of Yucca Mountain surface and sub-surface facilities incurs an additional, unnecessary risk burden to workers for every additional cubic meter of concrete poured and each meter of rebar used. While EPRI does not calculate total additional risk associated with such conservatism in the repository design, it is clear that such risks are significant in that the construction industry is routinely cited as one of the most hazardous occupations by the Bureau of Labor Statistics.

There are two primary scenarios for which impacts from manufacturing and transportation of heavy components are pertinent:

- unnecessary use of titanium drip shields, and
- additional emplacement drift construction and the associated infrastructure required by the disposal of smaller waste packages (i.e., containing less CSNF than necessary).

E.1 Unnecessary Use of Titanium Drip Shields

By invoking the use of drip shields, the DOE is incurring substantial resource demands for titanium, a material of significant strategic importance and of limited domestic availability. DOE estimates that its projected schedule for drip shield manufacture will result in consumption of 22% of present day annual U.S. production of Ti for a limited period of time as shown in Table E-1. Moreover, manufacture of the drip shields incurs occupational risks to involved workers. The YMSEIS (DOE, 2008a) estimates that 11,500 drip shields will be used under the Proposed Action. And as a heavy component, the YMSEIS assumes that 25 drip shields will be shipped per rail car, with a total of 460 shipments. The YMSEIS assumed a shipping distance of 3,464 km, resulting in pollution health effect fatalities of 0.028 and vehicle fatalities of 0.036 – or *total fatalities of 0.064 associated with the transport of drip shields from manufacturing facilities to the proposed repository.* (DOE 2008b, Transportation File, Attachment 12, Other materials.

In addition to the fatalities associated with transport of the drip shields, offsite manufacturing of 11,500 drip shields is estimated to take3.5 million labor hours. The YMSEIS analysis of off-site manufacturing health and safety impacts assumed 9.1 injuries per 100 full-time worker years and 3.29 fatalities per 100,000 worker years. *This results in 159 injuries and 0.609 fatalities associated with off-site manufacturing of the drip shields.* (DOE 2008b, Offsite Manufacturing File, Attachment A.)

Table E - 1
Materials Required for Repository Construction and Component Manufacturing (DOE, 2008a Final SEIS, Tables 4-30, 4-36

Material	Quantity	Proj. percentage of U.S. annual production
Concrete	490,000 m^3	
Cement	190,000 metric tons	
Carbon Steel	280,000 metric tons	
Copper	670 metric tons	
Copper*	140	0.0004%
Titanium*	54,000 metric tons	22%
Chromium*	100,000 metric tons	1.8%
Nickel*	120,000 metric tons	3.6%
Molybdenum	27,000 metric tons	1.9%

*Quantities are for repository components only, not total repository construction.

E.2 Additional Infrastructure to Support Additional Waste Package Emplacement

Each additional (unnecessary) WP emplaced at YM would require 5.6 m of drift and associated infrastructure, including one emplacement pallet, DS segment, and one TAD canister with outer waste package. The total quantities of materials associated with repository construction and component manufacture are summarized in Table D-1. Table E-2 summarizes the total number of repository components manufactured offsite. The YMSEIS estimates total worker injuries of 1,686 and total worker fatalities of 0.61 associated with manufacture of offsite components under the health and safety impact assumptions identified in the note on Table E-2.

The YMSEIS analysis of off-site manufacturing health and safety impacts assumed 9.1 injuries per 100 full-time worker years and 3.29 fatalities per 100,000 worker years. Assuming that the manufacturing of off-site components takes a total of 37 million labor hours and an average worker year is 2000 hours, the YMSEIS calculated total worker years of 18,500, resulting in 1,685 injuries and 0.61 fatalities associated with off-site manufacturing. (DOE 2008b, Offsite Manufacturing File, CalcPkg_Manufacturing1_AttchA.xls).

E.3 References

DOE 2008a. Final Supplemental 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, DOE/EIS-0250F-S1, LSN #: DEN001593669.

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Table E - 2
Repository System Components Manufactured Off-Site

Component	Materials	Number	Weight (Metric tons)	Number of Shipments
Waste Packages (outer)	Alloy 22	11,200	22-34	5,589
TAD Canisters	Stainless steel	7,400	29 - 31	3,700
Emplacement pallets	Alloy 22 and stainless steel	11,200	2	5,302
Titanium drip shields (section)	▪ Grade 7 Ti – surface plates ▪ Grade 29 Ti-structural components ▪ Alloy 22 - base	11,500	4.9	460
Aging overpacks (carbon steel components)	Carbon steel liner and shell	2,500	43	1,250
Note: The YMSEIS estimates health and safety impacts associated with off-site manufacturing of repository components to be 3.3 fatalities per 100,000 worker years; 9.2 illness/injuries per 100 FTE. A 24 year manufacturing period is assumed for all components except drip shields. Drip shields are manufactured over a 10 year period.				

Source: DOE 2008a, Section 4.1.14.2; DOE 2008b, Offsite Manufacturing File, Attachment A.

F

METHODOLOGY FOR EPRI'S INDEPENDENT PROBABILISTIC VOLCANIC HAZARD ANALYSIS

EPRI has recently conducted an independent assessment of the likelihood of a future volcanic event occurring at the proposed Yucca Mountain repository site. A more detailed report on this issue will be released later this year. The assessment methodology adopted in the EPRI study was based on same methodology applied in the 1996 Probabilistic Volcanic Hazard Analysis (PVHA) report (CRWMS M&O, 1996, pp. 2-19). The purpose of EPRI's study was to independently develop new insights and probability estimates for future volcanism based on the more recent, extensive geological and structural data obtain in the last 12 years in the Yucca Mountain region (YMR).

EPRI's PVHA study includes consideration of new geochemical, geophysical, seismological, geodetic and age-dating data collected since the 1996 PVHA report (e.g., Brocher et al., 1998; Day et al., 1998; Perry et al. 1998; Fridrich, 1999; Fridrich et al. 1999; Potter et al., 2002; 2004; Perry et al., 2005; Valentine et al., 2005; 2006; Parson et al., 2006; Valentine and Krough, 2006; Valentine and Perry, 2006; Gaffney et al., 2007; Perry, 2007; Valentine and Perry, 2007; Valentine et al. 2007; Keating et al, 2008). In particular, EPRI's calculation includes information from drilling (Perry et al., 2005; Perry, 2007) and characterization (i.e. age dating) of various anomalous features identified by recent high resolution aeromagnetic surveys (O'Leary et al., 2002; Perry et al., 2005) buried under alluvial deposits that have been speculated to be additional volcanic centers (Perry et al, 2004; Smith and Keenan, 2005). Furthermore, EPRI's independent update to the 1996 PVHA report includes consideration of structural factors that demonstrably have controlled the actual eruptive location of volcanic centers that have occurred in the Yucca Mountain region in the last 12 million years (Valentine and Perry, 2006; 2007; Gaffney et al., 2007; Keating et al, 2007). As noted by the NRC's Advisory Committee and Nuclear Waste (ACNW) report on volcanism (ACNW, 2007, pp. 63), for example, there has been no igneous intrusion into Yucca Mountain block in the last 10 million years.

The approach taken by EPRI follows that used in the 1996 PVHA (CRWMS M&O, 1996). The approach involves defining an igneous (volcanic) event that may intersect the footprint of the proposed repository within the next 10,000 to 1,000,000 years. The calculation requires that an igneous event be well defined and its characteristic features be quantified, and the identification of factors that govern the location and timing of a possible future igneous event in the YMR. By following a similar approach as the 1996 PVHA calculation, results from EPRI's calculation may be compared and evaluated to results in the 1996 PVHA (CRWMS M&O, 1996) and a planned PVHA-U (the updated version of the 1996 PVHA) by the DOE. The estimated annual frequency of intersection in the 1996 PVHA (CRWMS M&O, 1996) is expressed as:

$$\nu = \frac{N(R,T)}{T} \cdot \frac{a_r}{A_R}$$

where, N(R,T) is the number of events that have occurred in region R in time period T, A_R is the area of region R and a_r is the area of the repository. The above equation is expanded to the following expression to account for alternative temporal and spatial models (CRWMS M&O, 1996):

$$\nu = \iint_R \int\int \lambda(x,y,z)\, P_I(x,y)\, dx\, dy = \frac{N(R,T)}{TA_r} \iint_r dx\, dy = \frac{N(R,T)}{T} \cdot \frac{a_r}{A_R}$$

where, $\lambda(x,y,t)$ is the rate density function (frequency of events per unit time per unit area), and P_I is the conditional probability (for a point source event, $P_I = 1$ inside the effective region of interest *r*, and 0 everywhere else). $\lambda(x,y,t)$ is separated into two parameters: $\lambda(t)$, rate parameter ($N(R,T)/T$), and $f(x,y)$ spatial density ($1/A_R$). The probability calculation requires an understanding of an expected igneous event in the area of interest as well as an assessment of the spatial and temporal parameters.

The framework for EPRI's probability calculation is divided into fours steps. The first step is a review of recent data and development of EPRI's independent *conceptual model* for an expected igneous event in YMR in the next 10,000 to 1,000,000 years. The second step *defines EPRI's expected igneous event* that may intersect the repository including its characteristic features. The third step identifies EPRI's *region of interest* and factors that influence the spatial occurrence of an expected igneous event using a logic tree to illustrate alternative spatial as well as temporal models. The fourth step identifies and discusses the *time* of interest and *duration* of events.

For its Step 1 development of an independent conceptual model, EPRI evaluated trends in Yucca Mountain field data that includes geochemistry, volume, and location of volcanoes in YMR, as well as recent tectonic models, EPRI believes that if an eruption were to occur in YMR in the next 10,000 to 1,000,000 years, it would occur within the Crater Flat area, along a pre-existing fracture oriented perpendicular (N30E) to the least compressive stress field of the region and with a dip angle approaching vertical. The volcanic material would be alkali basalt, with eruption characteristics similar to volcanoes located within the Crater Flat area typified by the Lathrop Wells volcano. Furthermore, extensional trends in the YMR indicate the NE part of the basin (i.e., the location of the repository) will be less prone to future eruptions than the SW region.

"Event definition" in EPRI's Step 2 describes the expected ranges in characteristics of an igneous event that could intersect the repository at its proposed depth of 200-300 m below the surface of Yucca Mountain. At repository depths, the intrusion of igneous material occurs as a sheet-like dike; if this dike reaches the surface, the initial linear fissure eruption rapidly evolves into a eruptive conduit that can lead to formation of a scoria cone. Therefore, EPRI considers only dikes in its event definition; sills and conduits are considered to be features that develop after a dike has reached the surface. Important dike characteristics in the EPRI event definition include dike length and dike azimuth.

The region of interest (Step 3) in EPRI's PVHA analysis is defined by two areas, one large area and one smaller region. The larger region encompasses areas around the Yucca Mountain block in which the repository is located, to include Jackass Flats to the east, areas north such as Thirsty Mesa and Sleeping Buttes volcanoes, and areas south into the Amargosa Valley, and areas west bounded by the Bare Mountain fault. The smaller region considered by EPRI is essentially the Crater Flat structural domain with boundaries defined by faults: the Bare Mountain fault to the west, the Yucca Mountain fault to the north and the Gravity fault to the east. The larger region is

used to evaluate each volcanic event in YMR with respect to event definition and its relevance on the spatial and temporal models for predicting a future igneous event. The smaller region defines EPRI's area of interest for its spatial model.

Two spatial models are considered in the EPRI analysis; a Fault Capture Model, and a No Fault Capture Model. The Fault Capture Model is based on recent DOE studies that demonstrate how low volume (< 1.0 km^3) magmas tend to ascend through the crust along the path of least resistance (Valentine and Perry, 2006; 2007; Gaffney et al., 2007; Keating et al, 2008). Initially magma will migrate through the lithosphere as a self-propagating dike following a direction (N30E in the YMR) that is perpendicular to the regional least compressive stress direction. As the dike approaches the surface, it will intersect and follow a fracture with a similar azimuth (N30E) and a steep dip angle (> 60°). In EPRI's Fault Capture Model, only pre-existing faults are considered as probable locations for dikes and relative probabilities are assigned to faults that have been mapped in the Yucca Mountain region (Day et al., 1996; Potter et al., 2002; 2004; Perry, 2007) based on fault azimuth relative to the regional stress field (Stock et al., 1985). As an alternative, EPRI also considers a No Fault Capture Model in which it is assumed magma will ascend in a self-propagating dike that will reach with little influence from the pre-existing structure or topography. The dike will follow a path that is perpendicular to the least compressive stress direction. Probability distribution for event azimuth is assigned with respect to the regional stress field. This alternative model accounts for the uncertainty of an event that may not follow the Fault Capture Model. Both models consider lithostatic pressure and cumulative extension data in their evaluation of the location of a future event.

Finally, in Step 4 EPRI also considers temporal relationships and patterns of past eruptions as models for possible future eruptions in the YMR. In brief, EPRI evaluates two temporal conceptual models, one referred to as the Spatial Cluster Model and the other the Fault Initiated Cluster Model. The Spatial Cluster Model assumes that events are controlled by a regional tectonic event that initiates partial melting in the lithospheric mantle in one of the structural domains with the YMR. The Fault-Initiated Cluster Model assumes expected events are associated with localized fault movement.

Based on the more recent geological and structural data obtained by the US DOE (i.e., Valentine et al., 2005; 2006; Parson et al., 2006; Valentine and Krough, 2006; Valentine and Perry, 2006; Gaffney et al., 2007; Perry, 2007; Valentine and Perry, 2007; Valentine et al. 2007; Keating et al, 2008) and its own independent spatial and temporal models for controlling factors for the occurrence and eruption of igneous (volcanic) events, EPRI calculated a time-dependent probability of a future event intersecting a repository at Yucca Mountain (see Figure E-1). For a time 10,000 years after repository closure, EPRI's estimated range for igneous-event probability is 0.0 to 1.3 x 10^{-8} per year, with a mean value of 3.7 x 10^{-9} per year. For a period 1,000,000 years after repository closure, the estimated range for igneous-event probability is 0.0 to 7.3 x 10^{-9} per year, with a mean value of 3.0 x 10^{-9} per year. The decrease in probability values between 10,000 and 1,000,000 years (Figure F-1) is attributable to the time-dependent influence of EPRI's Spatial Cluster Model (i.e., events triggered by regional tectonic episode) imposed on the baseline of the Fault-Induced Cluster Model.

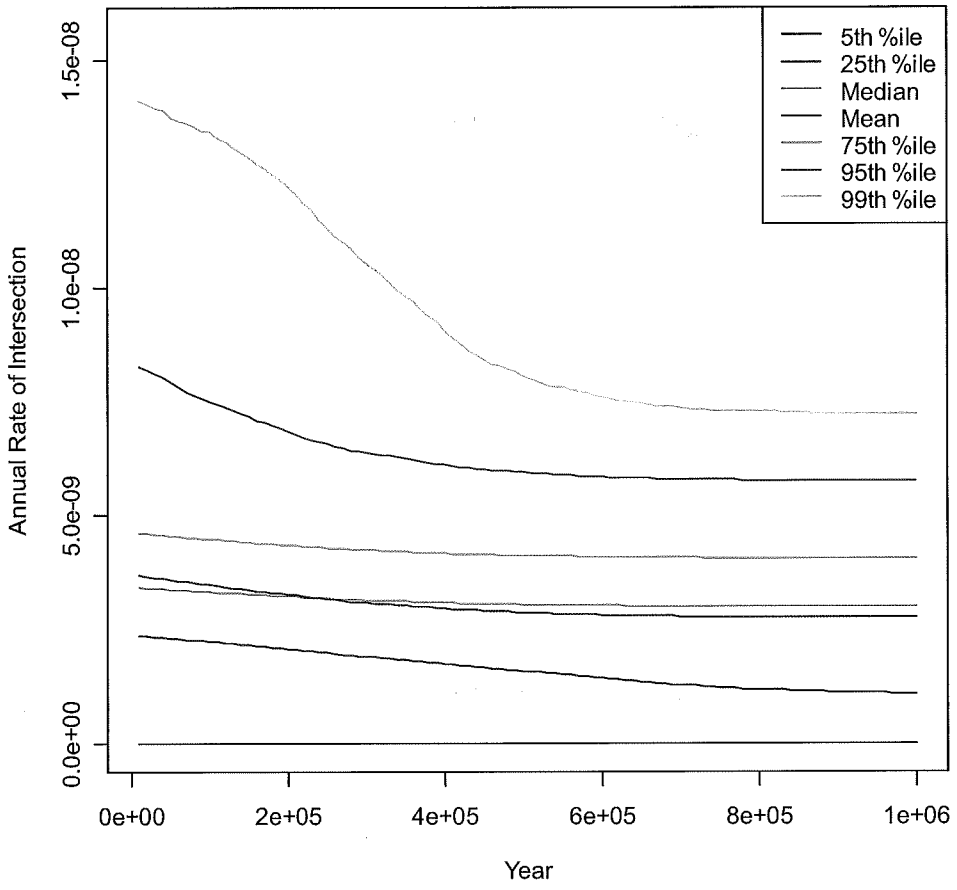


Figure F - 1
Calculated Probability for a Future Igneous Event Intersecting a Repository Located at Yucca Mountain, Nevada

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G
POTENTIAL ECONOMIC IMPACTS

In additional to the radiological and non-radiological impacts associated with DOE's decision to utilize the 21P/44B TAD canister rather than higher capacity canisters, there will also be economic impacts for nuclear operating companies. These economic impact include:

- Increased costs associated with loading additional packages at reactor sites
- Increased costs associated with transporting additional CSNF casks
- Increased costs to the DOE program associated with
    - The purchase of additional TAD canisters for transport, aging, and disposal
    - The purchase of additional waste packages for CSNF

EPRI has estimated the increased costs associated with DOE's decision to utilize the 21P/44B TAD canister rather than higher capacity canisters, as discussed in the sections below.

Under EPRI Case 1 assumptions, cost savings associated with using higher capacity TADs were estimated to be:

▪ At reactor loading costs	$0.38 billion
▪ Transport costs	$0.33 billion
▪ Disposal costs	$3.14 billion
▪ Total potential savings:	$3.85 billion

Unde rEPRI Case 2 assumptions, cost savings associated with using higher capacity TADs and assuming a minimal amount of CSNF is shipped by truck were estimated to be:

▪ At reactor loading costs	$0.44 billion
▪ Transport costs	$0.41 billion
▪ Disposal costs	$3.33 billion
▪ Total potential savings	$4.18 billion

G.1 Increased Cost Associated With Cask Loading and Handling At Reactor Sites

In calculating the costs associated with loading CSNF at reactor sites, EPRI assumed that TADs and DPCs would have a loading cost of $200,000 per package. Truck casks were assumed to have a loading cost of $50,000 per package. Using the number of packages estimated by EPRI in Appendix A, EPRI estimates that under EPRI Case 1, loading costs at reactor sites could be reduced by $0.38 billion if DOE adopted larger capacity TAD packages rather than the 21P/44B TAD design as shown in Table G-1. Under EPRI Case 2, loading cots at reactor sites could be reduced by $0.44 billion if DOE adopted a larger capacity TAD package and truck sites idenfied by DOE in the YMSEIS instead shipped CSNF in large capacity TADs.

DOE's YMSEIS assumes that all TADs loaded with CSNF at reactor sites will be stored at reactor ISFSIs prior to being transported to the repository for disposal. Thus, in addition to the increased costs associated with loading a greater number of 21P/44B TAD canisters, there will be an increase in the size of the ISFSI storage pad needed to store the additional TAD packages at reactor sites, compared to storing a smaller numer of higher capacity TADs or DPCs. EPRI has not attemped to quanitify the incremental ISFSI pad construction costs associated storing additional 21P/44B TAD packages at reactor sites since these costs would be site specific.

Table G - 1
Estimated Costs Associated with Cask Loading and Handling At Reactor Sites

Package Type	Loading Cost/Package	DOE YMSEIS	EPRI Case 1	EPRI Case 2
TAD 21P/44B	$200,000	$1.3 billion		
Large Capacity TAD 24P/32P,61B,68B	$200,000		$0.92billion	$0.99 billion
DPC	$200,000	$0.06 billion	$0.06 billion	$0.06 billion
Truck	$50,000	$0.13 billion	$0.13 billion	0
Total Cost		$1.49 billion	$1.11 billion	$1.05 billion
Cost Reduction			$0.38 billion	$0.44 billion

G.2 Increased Costs Associated With Transporting CSNF

The YMSEIS calculated a 2,833 total rail shipments (assuming three casks per train) for CSNF, DOE and Navy SNF, and HLW; and 2,650 truck shipments. As summarized in Table G-2, under EPRI Case 1 there would be an estimated 2,074 rail shipments, assuming three casks per train, and 2,650 truck shipments. Under EPRI Case 2 there would be an estimated 2,186 rail shipments (assuming 3 casks per train) and 2 truck shipments. The estimated rail shipments in the DOE YMSEIS, EPRI Case 1 and EPRI Case 2 include shipments of CSNF, DOE and Navy SNF, and DOE HLW.

DOE's July 2008, "*Analysis of the Total System Life Cycle Cost (TSLCC) of the Civilian Radioactive Waste*" (DOE 2008c) assumes that the costs for transport operations execution will be $3.12 billion to transport a total of 4,239 truck casks and 16,619 rail casks containing CSNF, DOE HLW and DOE SNF. EPRI estimated the unit costs per cask transported using data from DOE's 2008 TSLCC. EPRI assumed that the cost to transport one truck cask from reactor sites to Yucca Mountain would be $50,000. Thus, using DOE's data from the 2008 TSLCC, truck cask transportation would account for $211.95 million out of the total $3.12 billion. Dividing the remaining $2.91 billion by 16,619 rail casks assumed in the 2008 TSLCC, results in a cost per rail cask shipment of $175,100 per cask. It should be noted that the number of shipments in the 2008 TSLCC is higher than those considered by EPRI in this report since the 2008 TSLCC is based on total CSNF arisings of 109,300 MTU as well as all of the DOE SNF and HLW, and Navy SNF. EPRI's analysis considers the quantities of CSNF considered under the Proposed Action for a 70,000 MTU repository.

As shown in Table B-5, under the assumptions in the YMSEIS, the cost to ship CSNF would be approximately $1.324 billion. If rail shipments of CSNF utilized higher capacity casks than the 21P/44B TAD design as assumed in EPRI Case 1, the estimated cost to transport CSNF would be $990 million, a reduction of $334 million compared to cost for shipment of CSNF using the 21P/44B TAD. If rail shipments of CSNF utilized higher capacity TADs and the truck sites identified in the YMSEIS instead shipped by higher capacity TADs, the estimated cost to transport CSNF would be $917 million, a reduction of $407 million compared to cost for shipment of CSNF using the 21P/44B TAD and truck casks.

Table G - 2
Estimated Costs Associated with Transport of CSNF to Yucca Mountain

Scenario	Number of Casks	Estimated Transport Cost (Millions $)
DOE YMSEIS (70,000 MTU)		
▪ **Rail Casks Shipped**	6,806	$1,192
▪ **Truck Casks Shipped**	2,650	$132
Total Transport Cost		$1,324
EPRI Case 1		
▪ **Rail Casks Shipped**	4,898	$858
▪ **Truck Shipped**	2,650	$132
Total Transport Cost		$990
EPRI Case 2		
▪ **Rail Casks Shipped**	5,235	$917
▪ **Truck Shipped**	4	$0.2
Total Transport Cost		$917

G.3 Increased Costs To Handle and Disposal of CSNF

The YMSEIS assumed that a total of 7,400 TADs would be used for CSNF disposal under the proposed action (DOE 2008a, Table 4-32). As noted in Appendix A, the YMSEIS assumes that a total of 6,499 TADs are loaded with CSNF at reactor sites, leaving a total of 901 TADs to be loaded with commercial SNF that is shipped in the 307 DPCs and 2,650 truck casks. Under EPRI Case 1, a total of 4,591 higher capacity TADs are assumed to be loaded at nuclear power plant sites. If the CSNF shipped to the repository in DPCs and truck casks are repackaged at the repository into higher capacity TAD packages (32P, 68B), EPRI estimates that 489 packages would need to be loaded at the repository. Under EPRI Case 2, a total of 4,928 higher capacity TADs are assumed to be loaded at reactor sites. Under this scenario, there were two truck casks containing CSNF, which is assumed to be transferred to 1 TAD canister at the repository.

The 2008 TSLCC assumes that a PWR TAD will cost $700,000 and a BWR TAD will cost $800,000. For simplification, EPRI assumed an average TAD cost of $750,000. Under the YMSEIS assumptions, EPRI estimates that the cost of TAD canisters to dispose of CSNF would be $5.55 billion. Under EPRI Case 1, EPRI estimates that the cost of 5,080 larger capacity TAD canisters would be $3.81 billion, a reduction of $1.74 billion. Under EPRI Case 2, EPRI estimates that the cost of 4,929 larger capacity TAD canisters would be $3.70 billion, a reduction of $1.85 billion.

The YMSEIS calculation package assumed that the unit cost for TAD waste packages would be $600,000 (DOE 2008b, Offsite Manufacturing File, CalcPkg_Manufacturing1_AttchA.xls). Using the scenarios described in Table G-3, under the YMSEIS assumptions, EPRI estimates that the cost of TAD waste packages for disposal of CSNF would be $4.44 billion. Unde EPRI Case 1, EPRI estimates that the cost of 5,080 larger capacity TAD waste packages would be $3.04 billion, a reduction of $1.4 billion. Under EPRI Case 2, EPRI estimates that the cost of 4,929 larger capacity TAD canisters would be $2.96 billion, a reduction of $1.48 billion. As shown in Table G-3, the overall cost savings associated with the use of higher capacity TAD designs would be $3.14 billion under the assumptions in EPRI Case 1 and $3.33 billion under the assumptions in EPRI Case 2.

Table G - 3
Estimated Costs Associated with Disposal of CNSF in TAD Canisters

Scenario Description	Number of TADs	TAD Canister Cost (Billions $)	Waste Package Cost (Billions $)	Tota Cost (Billions $)
DOE YMSEIS (70,000 MTU)				
TADs Loaded at Reactors	6,499	$4.87	$3.90	
TADs Loaded at Repository	901	$0.68	$0.54	
Total Cost		$5.55	$4.44	$9.99
EPRI Case 1				
TADs Loaded at Reactors	4,591	$3.44	$2.75	
TADs Loaded at Repository	489	$0.37	$0.29	
Total Cost		$3.81	$3.04	$6.85
EPRI Case 2				
TADs Loaded at Reactors	4,928	$3.70	$2.96	
TADs Loaded at Reposiotry	1	$0.00	$0.00	
Total Cost		$3.70	$2.96	$6.66

G.4 References

DOE 2008a. Final Supplemental 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, DOE/EIS-0250F-S1, LSN #: DEN001593669.

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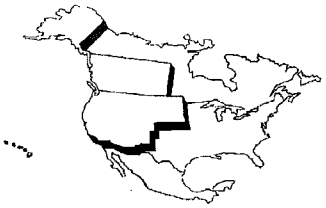
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ATTACHMENT 14



Western Interstate Energy Board/ WINB

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Arizona
British Columbia
California
Colorado
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Idaho
Nebraska
Nevada
New Mexico
Oregon
Saskatchewan
Utah
Washington
Wyoming

Tony Usibelli
Chairman

Douglas C. Larson
Executive Director

Summary of the April 22-23, 2008 Meeting of the High-Level Radioactive Waste Committee, in Tempe, Arizona

Eleven WIEB states participated (AZ, CA, CO, ID, NE, NV, NM, OR, UT, WA, WY). Roger Mulder, Director of the Pantex Program in the State Energy Conservation Office, represented the State of Texas. Also participating were representatives of Council of State Governments-Midwest (CSG-MW), Council of State Governments-Eastern Regional Conference (CSG-ERC), Southern States Energy Board (SSEB), and National Conference of State Legislatures (NCSL). The DOE/OCRWM Office of Logistics Management (OLM) was represented by Frank Moussa and Alex Thrower, Western Governors' Association (WGA) by Kevin Moran and Alex Schroeder, Nuclear Waste Technical review Board (NWTRB) by Karyn Severson, and Nuclear Regulatory Commission (NRC) by Earl Easton.

The agenda included:

- A joint session with WGA, on topics of mutual interest/concern.
- A states-only business meeting.
- An OCRWM program update
- A panel on National Transportation Plan issues
- A review of WIEB comments on NWPA Section 180(c)
- An update from the Nuclear Regulatory Commission
- SRG update reports
- Reports from Western States

WGA/WIEB Joint Meeting

In a joint meeting on Tuesday afternoon, the Committee received:

- A review of pending climate change legislation in Congress from Kevin Moran.
- A summary of NRC's RAMQC rulemaking and a discussion of risk communication resources, from Barbara Byron.
- A summary of a proposed pilot study to evaluate the usefulness of IRRIS (GeoSystems) in development of "rich" information on route conditions and needs, by Fred Dilger.
- A discussion of radiation specialist training programs (the Phase II Update), by Craig Halverson.

- A discussion of the clean-up progress and challenges at Hanford, by Ken Niles. This well-illustrated report reviewed the history of the Hanford site, the 1989 cleanup agreement, the extraordinary cleanup problems encountered, the cleanup progress made, and the considerable remaining challenges.
- A review of proposed and prospective enrichment and reprocessing facilities in southeastern New Mexico, by Christina Nelson.

States-Only Business Meeting

At the states-only business meeting Wednesday morning, the Committee received:

- A report on the status of the renewal of the 5-year DOE-WIEB cooperative agreement, from Jim Williams.
- A review (based on an April 8 conference call with DOE) of the basic parameters for WIEB HLW program budgets for the remainder of FY'08 and FY'09, from Jim Williams.
- An outline of WIEB budget plans for the remainder of FY'08 (including the pilot study) and for FY'09, from Doug Larson.

OCRWM Program Update

After a host state welcome from Aubrey Godwin, and an agenda review by Committee Co-chairs Barbara Byron and Joe Strolin, the Committee received an OCRWM program update from Alex Thrower (OCRWM/OLM):

- Despite the $108 million FY'08 appropriation funding reduction, the Yucca license application will be submitted in June 2008. Depending on the NRC review process, construction authorization is expected in September 2011, and an operations license application will be submitted March 2013.
- A new fee adequacy determination, a second repository report and an interim storage report will be released in the summer of 2008.
- The OLM budget will remain under $20 million until repository construction is authorized—i.e. at least until FY'12.
- DOE intends to issue the National Transportation Plan this summer. It will be "investment based"—investments are designed to create capabilities. Details will be presented in "nested" Systems Operations and Campaign Plans.
- DOE intends to expand its benchmarking efforts, as a means to identify "best practices."
- Nevada rail is intended to be operational prior to the opening of the repository, and is needed in order to ship 3000 MTHM/year.
- The railroads' routing suggestions from 12 origins to a Caliente destination are expected within a few weeks. (Rail Topic Group: Proposed Standard Problem).
- DOE has just begun to review comments on the Section 180(c) Federal register Notice. The Section 180(c) pilot project is "schedule and funding dependent."
- It is unclear how Section 180(c) will be funded. Will it be a DOE line item

request based on state needs assessments, with priorities based on queue?

National Transportation Plan (NTP) Issues

Co-chair Joe Strolin (NV) introduced the session, focusing on linkages between the Repository SEIS proposed action (68 specified sites shipping cross-country by dedicated train) and the implementation hurdles that must be address in the NTP. Among these are the allocation of acceptance slots needed to make-up dedicated trains, the implementation of the TAD canister system, the resolution of intermodal issues at numerous shipment origins, and the identification of best practice in the use of overweight trucks

- Jim Williams (WIEB) discussed "the question of queue," arguing that, while liability issues make it impractical to resolve the question now, neither can or should it be ignored, as the issue is fundamental to a best practice cross-country shipment campaign. Williams has preliminarily assessed several possible criteria for waste acceptance, considering the origins involved (and excluded), the age of SNF shipped, and the number of queue slot trades required for implementation.
- Rod McCullum (NEI) discussed DOEs Transportation-Aging-Disposal (TAD) canister system, emphasizing their role in integrating a used fuel management system. Shipping oldest-fuel-first is a "non-starter" from a business standpoint; utilities need to remove (generally younger) SNF from pools. While utilities generally support the TAD concept, they do not intend to purchase (and load) TADs until waste acceptance—i.e. 2017 or later. Meanwhile, SNF removed from pools will be placed in dual purpose canisters, which utilities do not intend to reload to TADs for shipment. SNF removed from pools for on-site dry storage will be shipped in dual-purpose canisters (DPCs), and reloaded to disposal canisters at the repository site. The number of DPCs is therefore likely to greatly exceed the 307 estimated in the Repository SEIS proposed action. TAD's reduce fuel handling at the repository and may contribute to waste confidence, but utilities do not intend to pay the incremental cost or reload DPCs before shipment.
- Bob Halstead (NV-NWPO) addressed intermodal transport issues. By his count, 22 origins require intermodal transport,[1] many of which have queue slots that could result in early shipment. Halstead argues that many issues in intermodal transport have not yet been seriously addressed, and should be addressed on a site-specific basis. He also argues that intermodal issues may complicate other transportation process, such as Section 180(c) implementation, and/or implementation of HM-232E rail routing and security

1 Of these, 7 are also listed in SEIS Table G-7; 15 are not listed. Seven origins listed in SEIS Table G-7 are not included on Halstead's list.

rules.

- Rod McCullum (NEI) made a presentation on the use of overweight trucks, and John Hauser (Tri-State) provide additional comments. Overweight trucks are 80-115,000 pounds; after delivery (i.e. without SNF) most such would be oversize but not overweight. Overweight trucks are subject to state restrictions (time of day, holidays, time of year, etc.) which may vary by state and are issued for each shipment. Overweight truck shipment occurs on a daily basis nationwide. SNF shipment by overweight truck (mostly in the 1980s) includes 31 shipments from West valley to Dresden, IL (570 miles), 33 shipments from West Valley to Oyster Creek, NJ (420 miles), and 16 shipments from Surry, VA to Idaho National Laboratory (2800 miles). Overweight truck shipment casks (e.g. GA-4/9) could be shipped by rail, but at only one cask per rail car.

NWPA Section 180(c) Federal Register Notice

Tammy Ottmer, who participated in the extensive TEC Topic Group discussion of Section 180(c), summarized the purposes behind WIEB comments on the July 2007 Federal Register Notice: a) to reflect Topic Group issue paper recommendations, negotiated principles of agreement, and relevant WGA resolutions; b) to raise again the issues of funding and funding distribution; and c) to raise again the issue of needs, in addition to training.

U.S. Nuclear Regulatory Commission Report

Earl Easton provided a report on current activities at NRC:

- NRC's response to the WGA letter on spent fuel schedules is expected in a few weeks.
- RAMQC rulemaking will begin in May 2008 and will be finalized in Spring 2009.
- NRC's "waste confidence" decision is under review to determine if revision is needed.
- The NRC package performance study continues; a decision on full-scale testing will be tied to TAD submittal and approval.
- NRC's information on cask vulnerability is currently focused on vendors, but NRC has not forgotten its commitment to the SRGs (See Oct. 15, 2007 letter.)

SRG Update

Lisa Janairo (CSG-MW) invited other SRGs to her June 18-19 meeting in Indianapolis. She hopes to update the CSG-MW transportation guide in this fiscal year. Lisa and Ken Niles are proposing a stakeholder panel at the Waste Management Conference in early 2009. There was some discussion (involving DOE) about the value of the WM Conference in general, and the stakeholder panel in particular.

Ken Niles summarized the paper presented at the February 2008 WM Conference, co-authored with Lisa Janairo: "Why DOE's Messages on Transportation Don't

Resonate With the Public." The paper explored the persistent disparity between expert and lay perceptions of risk. Considering eleven "outrage factors" in risk communication, the authors reviewed 40 DOE fact sheets, booklets and brochures, finding consistent patterns of miscommunication. The authors then made several recommendations. The paper is likely to be a key text in DOE's effort to respond to issues raised by Hank Jenkins-Smith at the February TEC meeting in San Antonio.

Reports From Western States

Nevada is developing 500-900 contentions regarding the anticipated Yucca license application. Also, Nevada will participate in the STB's review of the Nevada rail spur as an element in a national rail transportation system.

Oregon is continuing its 20-year practice of conducting a radiological training course at OSU, which has a reactor.

Nebraska is planning a training exercise in North Platte.
Idaho: Craig Halverson has monitored the nuclear plant proposals of MidAmerican energy and Alternate Energy Holdings. He reviewed his findings and suggested a future session on the changing nuclear energy context for nuclear waste transportation.

Utah: Connie Nakahara reviewed the status of litigation regarding the PFS Interim Storage Project at the Goshute Reservation. She also noted Governor Huntsman's intention to oppose the importation of Italian nuclear waste by Energy Solutions.

Washington: Larry Goldstein noted that his state appealed a ruling against Washington on waste importation.

Wyoming: Scott Ramsay discussed applications for 4 new in-situ uranium mines in Wyoming.

California: Barbara Byron mentioned the 2007 CEC report on the status of nuclear power. A bill to repeal the CA moratorium recently failed to pass in the State Legislature. The CEC is currently conducting a study on the replacement of steam generators at Diablo Canyon and San Onofre.

Wrap Up

The Committee agreed to proceed with the pilot study regarding applications of IRRIS. The Committee concurred with the general approach outlined by Doug Larson for dealing with FY'09 budget limitations. Portland was suggested as a possible location for a next meeting.

ATTACHMENT 15

Integrated System Operations

Industry Perspectives

Rod McCullum, Nuclear Energy Institute

Nuclear Waste Technical Review Board

Las Vegas, Nevada

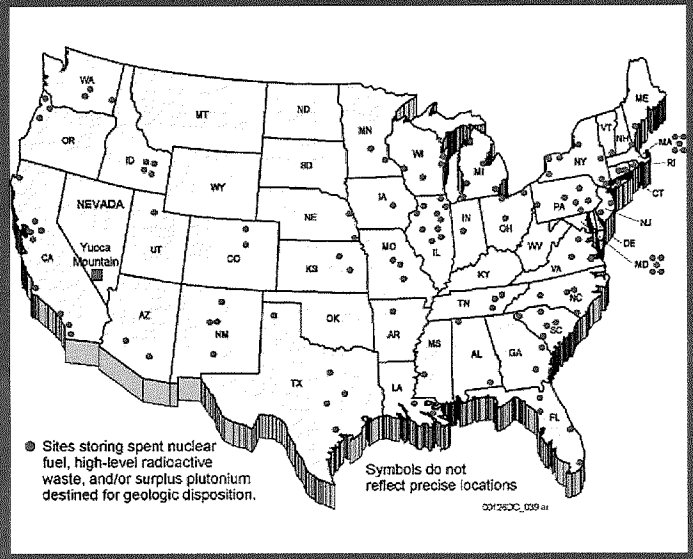
September 24, 2008

NEI

NUCLEAR ENERGY INSTITUTE

Used Nuclear Fuel Storage

- Current used fuel inventory
  - Approximately 60,000 MTU
- Current dry storage inventory
  - 11,771 MTU
  - 1017 casks/canisters loaded
  - At 47 sites
- Future dry storage by 2020
  - Estimating 25,300 MTU
  - 2,100 casks/canisters loaded
  - At 70 sites

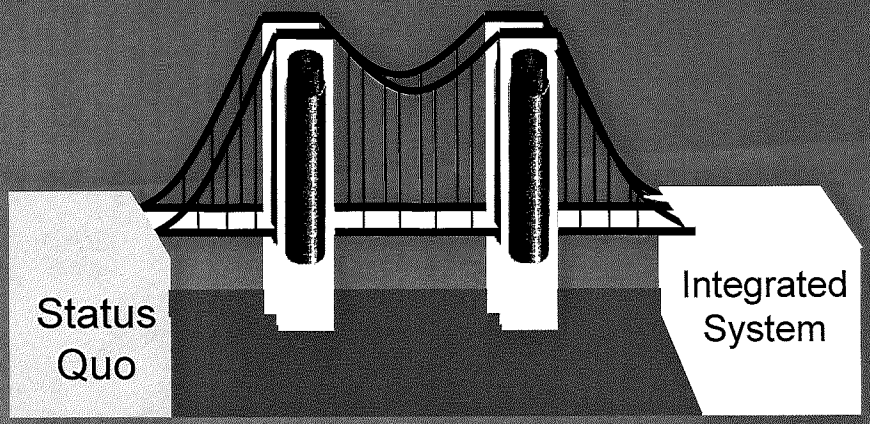


Integrated Used Fuel Management

- Three-pronged approach to used fuel management
  - Interim storage at centralized location(s)
  - Research, development, and commercial demonstration to close the nuclear fuel cycle
    - recycling used nuclear fuel
    - advanced used fuel reprocessing technologies
    - developing new type of fuel from reprocessed product
    - new reactor designs
  - Permanent disposal facility
    - Yucca Mountain site judged suitable by Congress in 2002
    - Yucca Mountain licensing process underway
- Divided into short, medium, and long term goals

NEI

Transportation, Aging and Disposal Canisters (TADs) – an integration tool



- Provide for one time loading of used nuclear fuel at the reactor site
- Connect long-term disposal goals to today's real world of used fuel management
- Are similar to dual purpose dry storage systems already in use (DPCs) – but meeting additional disposal requirements results in reduced capacity and increased costs

NEI

TAD Progress

Date	Accomplishment
11/2005	DOE presents TAD concept to industry
1/2006	DOE industry technical dialogue on TADs begins
4/2006	DOE qualifies four vendors to submit proposals for TAD designs
11/2006	DOE publishes Draft TAD Performance Specification
2/2007	Vendors complete TAD proof-of-concept designs
6/2007	DOE publishes final TAD Performance Specification
7/2007	DOE issues procurement for TAD demonstrations (Vendors are asked to submit proposals for obtaining an NRC license for a TAD and working along with a reactor owner to deploy that TAD at one or more reactor sites)
8/2007	Four vendors submit proposals for TAD demonstrations
5/2008	Two vendor teams are awarded contracts to license and deploy demonstration TADs
2013	Earliest date for commercial availability of TADs

Industry perspectives on TADs

- TAD advantages benefit industry
  - Reduced fuel handling @ repository, simplified design improves repository licensability
  - Reduced disposal and waste acceptance uncertainty
  - Increased confidence that on-site storage is *temporary*
  - Represents the first step towards integrating the overall used nuclear fuel management system
- Industry/DOE dialogue has resolved technical issues
- But will the benefits of TADs be realized?
  - TADs will only be deployed for storage at reactor sites if doing so can be justified as a sound business decision
    - DOE incentives must compensate for increased cost of TADs
  - DOE must continue to support vendors with timely decisions, uninterrupted process, and responsiveness to technical concerns
  - Industry must have confidence that Yucca licensing will continue

NEI

Systems integration beyond TADs

- DOE's "best achievable" date to open Yucca Mountain is 2020
- The nation's used fuel management system will evolve significantly between now and 2020
- The TAD experience demonstrates that specific integration strategies can be developed in relatively short time frames
- Continued demonstration work on TADs between now and 2013 will adequately position the system for the next steps at a time when it is more appropriate to begin planning those steps
  - e.g., specific system operational strategies can not be defined until the configuration of the system at the time DOE is ready to begin receiving used nuclear fuel is better known

NEI

Conclusion

- The nuclear industry is pursuing an integrated approach to used fuel management
- Yucca Mountain is currently part of that approach and TADs are a key integration tool
- Specific operational strategies for systems integration should be developed when it is appropriate to do so
  - Nature of future system evolutions must 1st be known
- It is currently too early to engage in detailed systems integration operational planning beyond continued TAD demonstration

NEI

ATTACHMENT 16

AFFIDAVIT OF ENGELBRECHT VON TIESENHAUSEN

I, Engelbrecht von Tiesenhausen, being first duly sworn, hereby depose and state as follows:

1. I am a citizen of the United States, and a resident of Las Vegas, Nevada.

2. My formal education consists of the following: A Bachelor of Applied Science from the University of British Columbia and a Master in Business Administration from Pepperdine University

3. My professional employment experience with respect to nuclear waste disposal, is as follows: For more than 18 years I was the technical advisor to Clark County on the Yucca Mountain Program

4. I have reviewed and am familiar with the applicable parts of the Yucca Mountain Repository License Application filed by the Department of Energy ("DOE") with the Nuclear Energy Commission ("NRC") in June, 2008 (the "LA") as they relate to this contention.

5. I have also reviewed and am familiar with the applicable parts of the Final Supplemental 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 (DOE/EIS-0250F-SI) ("SEIS") and the Final 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 (DOE/EIS-0250F) ("FEIS") as they relate to this contention.

6. It is not practicable for the NRC to adopt the DOE environmental impact statement (the FEIS), as it has been supplemented (in the SEIS), based upon the significant and substantial new information and new considerations set forth below which render the FEIS and the SEIS (together, the "NEPA Analyses") inadequate.

7. DOE's assumption in the NEPA Analyses potentially underestimates the number of shipments of SNF and HLW to be made to the repository by means of Dual Purpose Canisters (DPCs) by significant numbers, based upon the analysis which follows.

(a) The DOE assumption of the quantities of SNF to be shipped in Transportation, Aging and Disposal Canisters (TADs) (Final SEIS Section S.2.3.1, Page S-13; SAR Chapter 1, Section 1.2.1, Page 1.2.1-4) is based upon two arbitrary and specious assumptions.

(i) First, DOE assumes that legal agreements with most of the utilities will be concluded, containing provisions assuring shipping by means of TADs. It is equally valid to assume that such agreements will not be executed with some or most of the utilities. Rod McCullum stated that "while utilities generally support the TAD concept, they do not intend to purchase (and load) TADs until waste acceptance—i.e. 2017 or later. Meanwhile, SNF removed from pools will be placed in dual purpose canisters, which utilities do not intend to reload to TADs for shipment. SNF removed from pools for on-site dry storage will be shipped in dual-purpose canisters (DPCs), and reloaded to disposal canisters at the repository site." (WIEB Meeting Summary April 23, 2008, Rod McCullum, National Transportation Plan Issues). It would be a significant financial burden to repackage the SNF currently stored at the utility sites in TADs, as well as the additional SNF which will accumulate prior to the availability of TADs or the opening of the repository. Any decision with reference to the choice of shipping canisters will be made by the utilities based upon business considerations. (WIEB Meeting Summary April 23, 2008, Rod McCullum, National Transportation Plan Issues). Absent agreements enabling the use of TADs, DPCs would be more likely to be utilized than TADs.

8. Despite the factors set forth in Paragraph 7 above, DOE assumes that, at a maximum, the number of DPCs utilized for shipment would be 307. (SEIS Appendix A, Section A.2.1, Page A-3). The industry estimates the number of DPCs loaded at commercial generator sites, by the year 2020, could be 2,100 DPCs. (Rod McCullum, Nuclear Energy Institute Nuclear Waste Technical Review Board "Integrated System Operations Industry Perspectives" Presentation September 24, 2008). EPRI found that the number of DPCs loaded at commercial generator sites, by the year 2020, could be as high as 2,155. (Occupational Risk Consequences of the Department of Energy's Approach to Repository Design, Performance Assessment and Operation in the Yucca Mountain License Application. EPRI, Palo Alto, CA: 2008. 1018058, Page 4-1). In any event, the DOE estimate of DPC canisters is significantly and substantially lower than can reasonably be expected to be received at the repository.

9. By virtue of their proximity to the repository, residents of the Nevada Counties of Churchill, Esmeralda, Lander and Mineral are likely to become employees at the repository during repository operations, where they may reasonably be expected to be involved in the handling of SNF.

10. The analysis set forth in the NEPA documents fails to recognize how environmental and worker radiation exposure at the repository will change in proportion to the change in percentage ratios of DPCs received as contrasted with TADs received. Maximum worker does (annual individual doses, total individual does and total population doses) would differ significantly when processing DPCs as compared to when processing TADs.

11. As a result of the acknowledged and well recognized uncertainties and realities described in Paragraphs 7, 8, 9 and 10 above, DOE must properly analyze the alternative environmental effects upon repository employees of the receipt and handling of a quantity greater than the 307 DPC canisters of SNF which DOE forecasts will be received at the repository.

12. The failure to estimate the alternative effects the of receipt and handling of the alternative numbers of DPCs as described in Paragraphs 7, 8 and 9 above is a fatal flaw in the

NEPA Analyses in that a valid estimate of the number of such DPCs is vital to the determination of the environmental impacts and environmental effects upon the repository, the employees, and its related processes.

DATED: December __, 2008

ENGELBRECHT VON TIESENHAUSEN

State of Nevada)
)ss.
County of Clark)

Subscribed and sworn to before me this 18th day of December, 2008

Notary Public

SALLY T. CHRISTENSEN
Notary Public State of Nevada
No. 04-87256-1
My appt. exp. Feb. 1, 2012

NYE -JOINT-SAFETY-5

Failure to include the requirements of the National Incident Management System (NIMS), dated March 1, 2004, and related documentation in Section 5.7 Emergency Planning of the Yucca Mountain Repository Safety Analysis Report (SAR).

1. Statement of issue of law or fact. [2.309(f)(1)(i)]

The applicant failed to include key interoperability and standardized procedure and terminology requirements of the National Incident Management System (NIMS), in the Emergency Planning required as part of the Safety Analysis Report [Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR Section 5.7; SAR pp 5.7-1 to 5.7-55). LSN DEN001592183] to sufficiently ensure the ability of Nye County and other offsite agencies to properly plan and respond to onsite emergency actions. See requirements at 10 CFR 63.161 and 10 CFR 72.32(b).

2. Explanation of basis. [2.309(f)(1)(ii)]

The applicant is required by 10 CFR 61.161 and 10 CFR 72.32(b) to prepare an emergency plan which will provide for offsite notification and coordination, offsite assistance and participation in exercises, arrangements for providing information to the public, the training of offsite response personnel, and provisions for prompt communications among principal response organizations to offsite emergency personnel who would be responding onsite. The SAR addresses NRC directives and DOE requirements, but does not include the critical interoperability and communications requirements of the National Incident Management System (NIMS), dated March 1, 2004, that was promulgated subsequent to the NRC regulations cited above. NIMS has been implemented for the federal government under Homeland Security Presidential Directive/HSPD-5, dated February 28, 2003; HSPD-7, dated December 17, 2003; and by HSPD-

8, dated December 17, 2003. [Homeland Security Presidential Directive/HSPD-5 (February 28, 2003) Nye County RID # 7572, Nye County LSN Assession Number: nye_rid7572_01_00.pdf, an NRC LSN Assession number will be provided when available; HSPD-7(December 17, 2003) Nye County RID # 7573, Nye County LSN Assession Number: nye_rid7573_01_00.pdf, an NRC LSN Assession number will be provided when available; HSPD-8 (December 17, 2003) Nye County RID # 7574, Nye County LSN Assession Number: nye_rid7574_01_00.pdf, an NRC LSN Assession number will be provided when available.] Homeland Security National Preparedness Guidelines, dated September 2007, and the Homeland Security National Response Framework, dated January 2008, further describe how the various government agencies should work together. [Homeland Security National Preparedness Guidelines, dated September 2007, Nye County RID #7570, Nye County LSN Assession No. nye_rid7570_01_00.pd, an NRC LSN Assession number will be provided when available; Homeland Security National Response Framework, dated January 2008, Nye County RID #7571, Nye County LSN Assession No. nye_rid7571_01_00.pd, an NRC LSN Assession number will be provided when available.] NIMS and HSPD-5 are anticipated to be specifically included in the requirements of 10 CFR 73.32(b) as a subsequent, pertinent directive to ensure public safety and the full participation of Nye County in emergency planning and offsite assistance to Yucca Mountain. The absence of a specific reference to the new Federal requirements from the cited NRC regulations in no way alleviates DOE and NRC responsibility to ensure the implementation of such requirements.

3. Issue is within scope of proceeding. [2.309(f)(1)(iii)]

See response at 4.

4. Issue raised is material to finding NRC must make. [2.309(f)(1)(iv)]

a. The SAR contains no reference to the NIMS or Homeland Security Presidential Directive (HSPD)-5. The incorporation of NIMS is basic to ensuring the proper coordination and integration of Nye County and other offsite responder agencies in the emergency plan. "HSPD-5 requires all Federal departments and agencies to adopt the NIMS and to use it in their individual domestic incident management and emergency prevention, preparedness, response, recovery, and mitigation programs and activities, as well as in support of all actions taken to assist State, local, or tribal entities." [National Incident Management System, Preface, Homeland Security, March 1, 2004]

b. The SAR must include:

- "Notification and coordination. A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, ..." [10 CFR 72.32(b)(8)]
- "Exercises. (i) Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies." [10 CFR 73.32(b)(12)]
- "Comments on Plan. The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the initial submittal of the licensee's emergency plan before submitting it to NRC. Subsequent plan changes need not have the offsite comment period unless the plan changes affect the offsite response organizations." [10 CFR 72.32(b)(14)]
- "Offsite assistance. The applicant's emergency plans shall include the following:
  - a brief description of the arrangements made for requesting and effectively using offsite assistance on site and provisions that exist for using other organizations capable of augmenting the planned onsite response.
  - Provisions that exist for prompt communications among principal response organizations to offsite emergency personnel who would be responding onsite." [10 CFR 72.32(b)(15)]
- "Arrangements made for providing information to the public." [10 CFR 72.32(b)(16)]

c. Because the applicant failed to include NIMS or adopt the NIMS requirements, the NRC has no assurance of communications and equipment interoperability, or the integration of local

government participation in effective emergency planning and the provision of emergency information to the public. Failure to include these principles encourages site personnel to act independently of surrounding governmental agencies, greatly increases the likelihood of miscommunication and misunderstanding, and limits the ability of offsite responders to be sure their equipment will fully integrate with onsite equipment. Additionally, because the applicant intends to forward only those emergency plan changes deemed by the applicant to affect the offsite agency, it is very possible that important issues will be missed. The same holds true if the offsite agency does not coordinate changes to their plans.

5. Statement of alleged facts or opinions and references to be relied upon [2.309(f)(1)(v)]

a. While the DOE SAR addresses the NRC directives and DOE requirements as they are currently written, it does not include the requirements of the National Incident Management System (NIMS), dated March 1, 2004. NIMS has been implemented for the federal government under Homeland Security Presidential Directive/HSPD-5, dated February 28, 2003; HSPD-7, dated December 17, 2003; and by HSPD-8, dated December 17, 2003. [Homeland Security Presidential Directive/HSPD-5 (February 28, 2003) Nye County RID # 7572, Nye County LSN Assession Number: nye_rid7572_01_00.pdf, an NRC LSN Assession number will be provided when available; HSPD-7(December 17, 2003) Nye County RID # 7573, Nye County LSN Assession Number: nye_rid7573_01_00.pdf, an NRC LSN Assession number will be provided when available; HSPD-8 (December 17, 2003) Nye County RID # 7574, Nye County LSN Assession Number: nye_rid7574_01_00.pdf, an NRC LSN Assession number will be provided when available.] Homeland Security National Preparedness Guidelines, dated September 2007, and Homeland Security National Response Framework, dated January 2008, further identify how the various government agencies should work together. [Homeland Security National Preparedness Guidelines, dated September 2007, Nye County RID #7570, Nye County LSN

Assession No. nye_rid7570_01_00.pd, an NRC LSN Assession number will be provided when available; Homeland Security National Response Framework, dated January 2008, Nye County RID #7571, Nye County LSN Assession No. nye_rid7571_01_00.pd, an NRC LSN Assession number will be provided when available.] In accordance with the above directives, specific information on Nye County participation in the planning effort should be submitted to NRC in a future SAR revision or supplement prior to the License Application update required by NRC before DOE can be granted a license to receive and possess radioactive material under 10 CFR 63. This information should include the following revisions as a minimum.

- "Notification and coordination. A commitment to and a brief description of the means to promptly notify offsite response organizations and request offsite assistance, ..." [10 CFR 72.32(b)(8)]

- "The communications system provides communication services for data, voice, and video transmissions throughout the repository, both the surface and the subsurface. The communications system permits reliable communications under anticipated circumstances during both normal and emergency conditions. The communication system supports safeguards and security, fire protection, employee safety and health, construction, operations, and emergency management." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-12, Section 5.7.5.2.4.5). LSN DEN001592183]

- The preceding statement from the DOE License Application contains no reference to ensuring integrated or interoperable communications where offsite emergency responders are concerned. Interoperable communications are too critical to effective emergency response to merely assume they are in place. The same is true of Section 5.7.5.2.4.6 Emergency Communications (SAR p 5.7-12), in which there is no reference to communications with offsite emergency responders. Nye County believes that the inclusion of these specific NIMS concepts are required to ensure effective and efficient response capabilities are in place prior to an emergency.

    - "Effective communications, information management, and information and intelligence sharing are critical aspects of domestic incident management. Establishing and maintaining a common operating picture and ensuring accessibility and interoperability are principal goals of communications and information management." [National Incident Management System, page 54, Homeland Security, March 1, 2004]

- By including NIMS requirements, or at least a commitment to the requirements at this time, in the emergency plan, many of the assumed conditions will be specifically addressed. For example, the SAR Section 5.7.5.2.4.5 Communications, begins "The communications system provides communications services for data,

voice, and video transmissions throughout the repository, ..." Under this section all site communications are included – the unspoken assumption being that the site will be able to communicate with all surrounding offsite jurisdictions and any offsite responders. The same assumption that all communications will work appears in Section 5.7.5.2.4.6 Emergency Communications. Yet there is no assurance that all agencies involved will have interoperable communications – especially in an emergency situation. NIMS requires reviews for communications integration and interoperability and that steps be taken to ensure first responders can communicate with site personnel and networks.

- "Exercises. (i) Provisions for conducting quarterly communications checks with offsite response organizations and biennial onsite exercises to test response to simulated emergencies." [10 CFR 73.32(b)(12)]

- "Exercises will be conducted biennially, at a minimum, to test the adequacy and effectiveness of organizational command and control, implementing procedures, notification and communication networks, emergency equipment, response organization performance, and the overall emergency preparedness program. Exercises are designed and conducted for maximum realism and attempt to duplicate the sense of stress inherent in an actual emergency situation.

- Exercises will be designed to test integrated response capabilities of the repository and offsite response agencies, the NRC, and the DOE headquarters organization. Offsite response organizations (including the NRC and DOE headquarters organization) shall be invited to participate in the biennial exercises; however, their participation is not required." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-36). LSN DEN001592183]

- "Preparedness requires a unified approach. A major objective of preparedness efforts is to ensure mission integration and interoperability in response to emergent crises across functional and jurisdictional lines, as well as between public and private organizations." [National Incident Management System, page 30, Homeland Security, March 1, 2004] The inclusion of NIMS in the emergency plan will ensure that exercises are fully interoperable and utilize the same terminology and standard operating procedures for all responding agencies.

- "Comments on Plan. The licensee shall allow the offsite response organizations expected to respond in case of an accident 60 days to comment on the initial submittal of the licensee's emergency plan before submitting it to NRC. Subsequent plan changes need not have the offsite comment period unless the plan changes affect the offsite response organizations." [10 CFR 72.32(b)(14)]

    - "The Emergency Plan will be provided to offsite response organizations identified in the Emergency Plan for review prior to submittal to the NRC. The offsite response organizations will have 60 days to review and comment on the Emergency Plan. Offsite response organization comments, if provided, will be included with the Emergency Plan submitted to the NRC. Comments from offsite response organizations, as appropriate, will be dispositioned in subsequent revisions to the Emergency Plan. If

subsequent revisions to the Emergency Plan affect the offsite response organizations, future revisions will also be provided to those organizations for review. The comment period for subsequent revisions to the Emergency Plan will be 60 days. Comments provided by offsite organizations during this period will again be included with the revised Emergency Plan submitted to the NRC." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-41, Section 5.7.5.2.4.5). LSN DEN001592183]

b. The President, through the Department of Homeland Security, has required the implementation of NIMS by federal, state, local and tribal governments to avoid the inability to work together efficiently and seamlessly demonstrated during 9/11 and Hurricane Katrina. Based upon that hard learned emergency response experience there is no assurance that this section, while meeting the specific requirements of 10 CFR 72.32(b)(14), takes into account the coordination of all changes to emergency plans (onsite or offsite) that may have a possible bearing on nearby agencies. For example, changes in the number of personnel or equipment at a fire station due to mission changes may not be seen as affecting another agency. But the change may require a response from another location and an associated delay in arrival time to assist the other agency. Or, if both agencies decided to reduce their stations in an area due to budget restrictions, the ability of each to assist the other will have been reduced in an overall view. All changes need to be coordinated.

c. As stated in NIMS "Preparedness is the responsibility of individual jurisdictions; this responsibility includes coordinating various preparedness activities among all appropriate agencies within a jurisdiction, as well as across jurisdictions and with private organizations. This coordination is effected by mechanisms that range from individuals to small committees to large standing organizations. These mechanisms are referred to in this document as "preparedness organizations," in that they serve as ongoing forums for coordinating preparedness activities in advance of an incident. Preparedness organizations represent a wide variety of committees, planning groups, and other organizations that meet regularly and

coordinate with one another to ensure an appropriate focus on planning, training, equipping, and other preparedness requirements within a jurisdiction and/or across jurisdictions. The needs of the jurisdictions involved will dictate how frequently such organizations must conduct their business, as well as how they are structured. When preparedness activities routinely need to be accomplished across jurisdictions, preparedness organizations should be multijurisdictional.. Preparedness organization at all jurisdictional levels should:

- •establish and coordinate emergency plans and protocols including public communications and awareness;
- •integrate and coordinate the activities of the jurisdictions and functions within their purview;
- •establish the standards, guidelines, and protocols necessary to promote interoperability among member jurisdictions and agencies;
- •adopt standards, guidelines, and protocols for providing resources to requesting organizations, including protocols for incident support organizations;
- •set priorities for resources and other requirements; and
- •ensure the establishment and maintenance of multiagency coordination mechanisms, including EOCs, mutual-aid agreements, incident information systems, nongovernmental organization and private-sector outreach, public awareness and information systems, and mechanisms to deal with information and operations security." [National Incident Management System, Preface, Homeland Security, March 1, 2004, Nye County RID #7569, Nye County LSN Assession No. nye_rid7569_01_00.pd, an NRC LSN Assession number will be provided when available.]

d. Furthermore, DOE unilaterally assigning Nye County 60 days to review emergency plans and changes does not comply with the spirit of the communications requirements of NIMS. The commitment in DOE's emergency plan should be to engage in communications with local government to ensure a fully integrated emergency plan and response system is in place, to the extent that the local community agrees to work cooperatively. In the case of Nye County, it is our desire to work cooperatively with DOE to ensure the safety of our citizens. This entails a common communications plan, not simply the opportunity for Nye County to review documents 60 days before DOE unilaterally implements its emergency plans.

- "Offsite assistance. The applicant's emergency plans shall include the following:

- a brief description of the arrangements made for requesting and effectively using offsite assistance on site and provisions that exist for using other organizations capable of augmenting the planned onsite response.
- Provisions that exist for prompt communications among principal response organizations to offsite emergency personnel who would be responding onsite." [10 CFR 72.32(b)(15)]

- SAR Section 5.7.15.1 Planning Goals states: "To facilitate a coordinated and planned emergency response, provisions for advance arrangements with offsite organizations will be addressed in the Emergency Plan. These arrangements include:
    - •Identification of offsite response organizations that have agreed to provide support, as well as other support organizations capable of augmenting the planned onsite response
    - •Means for requesting offsite assistance
    - •Provisions for prompt communications among principal response organizations with offsite emergency personnel who would be responding
    - •Provisions for providing and maintaining emergency response facilities and equipment to support the emergency response
    - •The availability of adequate methods, systems, and equipment for assessing and monitoring actual or potential consequences of a radiological emergency
    - •Provisions for medical services for contaminated or injured individuals
    - •Arrangements for radiological emergency response training to be offered to offsite support organizations that may be called upon to assist in an onsite emergency
    - •Documentation of assistance agreements in the form of letters of agreement or memoranda of understanding." [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-42, Section 5.7.5.2.4.5). LSN DEN001592183]

- Provision for prompt communications does not ensure interoperable communications. Nor does the paragraph contain any reference to ensuring the equipment of the responding agencies is compatible with the onsite equipment. However, the following NIMS requirement exists for DOE and NRC.

- "Incident communications are facilitated through the development and use of a common communications plan and interoperable communications processes and architectures. This integrated approach links the operational and support units of the various agencies involved and is necessary to maintain communications connectivity and discipline and enable common situational awareness and interaction. Preparedness planning must address the equipment, systems, and protocols necessary to achieve integrated voice and data incident management communications." [National Incident Management System, page 18, Homeland Security, March 1, 2004]

- "Arrangements made for providing information to the public." [10 CFR 72.32(b)(16)]

- SAR Table 5.7-7 and Figure 5.7-1 contain no provision for a Nye County Representative within the Joint Information Center Staff to provide local liaison and insight for any information which will be released and which will affect the County and its residents. Nye County, as the Site Host for the repository, has a strong and practical interest in the impact that center pronouncements will have on county residents. [Yucca Mountain Repository License Application, General information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR p. 5.7-52, and p. 5.7-55). LSN DEN001592183]

- "Public Information Functions Must Be Coordinated and Integrated Across Jurisdictions and Across Functional Agencies; Among Federal, State, Local, and Tribal Partners; and with Private-Sector and Nongovernmental Organizations." [National Incident Management System, p. 36, Homeland Security, March 1, 2004]

e. In summary, the inclusion of NIMS in the emergency plan is not meant to denigrate the actions which have been taken to prepare this plan. It is intended to strengthen the plan by ensuring that all participants are working from the same integrated script (Standard Operating Procedures, terminology, etc.), with fully interoperable communications and equipment.

f. Nye County remains committed to a continued emergency management relationship with the Yucca Mountain Site, as is evidenced by the Memorandum of Understanding (MOU) between the US DOE/OCRWM and Nye County, Nevada signed by Edward F. Sproat, III, Director, DOE/OCRWM, on January 14, 2008, and by Joni Eastley, Chairman, Nye County Board of Commissioners, on February 5, 2008. [Memorandum of Understanding (MOU) between the US DOE/OCRWM and Nye County, Nevada signed by Edward F. Sproat, III, Director, DOE/OCRWM, on January 14, 2008, and by Joni Eastley, Chairman, Nye County Board of Commissioners, on February 5, 2008, Nye County RID #7575, Nye County LSN Assession No. nye_rid7575_01_00.pd, an NRC LSN Assession number will be provided when available.] The MOU delineates communication and coordination for mutual assistance associated with DOE/OCRWM activities and the commitment to participate in

broader multi-agency emergency response and planning activities to include all governmental agencies active in Nye County.

6. References to portions of the application or environmental documents. [2.309(f)(1)(vi)]

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR Section 5.7; SAR pp 5.7-1 to 5.7-55). LSN DEN001592183

Homeland Security Presidential Directive/HSPD-5 (February 28, 2003) Nye County RID # 7572, Nye County LSN Assession Number: nye_rid7572_01_00.pdf, an NRC LSN Assession number will be provided when available;

Homeland Security Presidential Directive/HSPD-7(December 17, 2003) Nye County RID # 7573, Nye County LSN Assession Number: nye_rid7573_01_00.pdf, an NRC LSN Assession number will be provided when available;

Homeland Security Presidential Directive/HSPD-8 (December 17, 2003) Nye County RID # 7574, Nye County LSN Assession Number: nye_rid7574_01_00.pdf, an NRC LSN Assession number will be provided when available.

Homeland Security National Preparedness Guidelines, dated September 2007, Nye County RID #7570, Nye County LSN Assession No. nye_rid7570_01_00.pd, an NRC LSN Assession number will be provided when available.

Homeland Security National Response Framework, dated January 2008, Nye County RID #7571, Nye County LSN Assession No. nye_rid7571_01_00.pd, an NRC LSN Assession number will be provided when available.

National Incident Management System, Preface, Homeland Security, March 1, 2004, Nye County RID #7569, Nye County LSN Assession No. nye_rid7569_01_00.pd, an NRC LSN Assession number will be provided when available.

Memorandum of Understanding (MOU) between the US DOE/OCRWM and Nye County, Nevada signed by Edward F. Sproat, III, Director, DOE/OCRWM, on January 14, 2008, and by Joni Eastley, Chairman, Nye County Board of Commissioners, on February 5, 2008, Nye County RID #7575, Nye County LSN Assession No. nye_rid7575_01_00.pd, an NRC LSN Assession number will be provided when available.

10 CFR 63.161

10 CFR 72.32(b)

7. Statement Regarding Joint Ownership

Nye County is jointly sponsoring this Safety Contention with the Nevada Counties of Churchill, Esmeralda, Lander, and Mineral, and Inyo County, California.

NYE - JOINT-SAFETY-6

The LA lacks any justification or basis for excluding potential aircraft crashes as a category 2 event sequence.

1. Statement of Issue of Law or Fact (2.309(f)(1)(i))

Contrary to the requirements of 10 CFR 63 to provide the technical basis for the inclusion or exclusion of specific human-induced hazards in the repository preclosure safety analysis, the Department of Energy (DOE) has merely assumed the U.S. Air Force (USAF) will restrict their activities in the repository vicinity. No basis or justification for that assumption is provided by DOE in its repository License Application (LA) or supporting documents.

2. Explanation of Basis 2.309(F)(1)(ii))

In its LA Safety Analysis Report (SAR), DOE takes credit for various flight restrictions on USAF operations in the vicinity of the proposed repository (SAR section 1.6.3.4.1, pages 1.6-21, -22, and -23). In the same SAR section on page 1.6-22, DOE states, "The accident an alysis conducted assumed that such flight restrictions would occur." No further basis or justification of this critical assumption is discussed. In the same SAR section on page 1.6-23, DOE discusses its event sequence probability calculations (based in large part on the noted unsupported assumption) and states, "Consequently, the aircraft hazard to the surface facilities is screened out as an initiating event."

3. Issue is Within the Scope of the Proceeding (2.309(f)(1)(iv))

Determination of potential event sequences is a key step in DOE's repository preclosure safety analysis required by 10 CFR 63.112. Without understanding the potential event sequences and their probability, neither NRC, nor other stakeholders can judge with reasonable assurance that the repository can be operated safely. The regulatory basis for this requirement is described in detail in the next section of this contention.

4. Issue Raised Is Material to Findings NRC Must Make (2.309(f)(1)(v))

a. 10 CFR 63.111 states the performance objectives for the repository through permanent closure. The relevant portions of that regulation states the following requirements:

Preclosure Performance Objectives

§ 63.111 Performance objectives for the geologic repository operations area through permanent closure.

* * *

(b) Numerical guides for design objectives.

* * *

(2) The geologic repository operations area must be designed so that, taking into consideration any single Category 2 event sequence and until permanent closure has been completed, no individual located on, or beyond, any point on the boundary of the site will receive, as a result of the single Category 2 event sequence, the more limiting of a TEDE of 0.05 Sv (5 rem), or . . .

(c) *Preclosure safety analysis*. A preclosure safety analysis of the geologic repository operations area that meets the requirements specified at § 63.112 must be performed. This analysis must demonstrate that:

(2) The design meets the requirements of § 63.111(b).

* * *

b. Preclosure safety analysis is defined in 10 CFR 63.112. The relevant portions follow:

§ 63.112 Requirements for preclosure safety analysis of the geologic repository operations area.

The preclosure safety analysis of the geologic repository operations area must include:

(a) A general description of the structures, systems, components, equipment, and process activities at the geologic repository operations area;

(b) An identification and systematic analysis of naturally occurring and human-induced hazards at the geologic repository operations area, including a comprehensive identification of potential event sequences;

* * *

(d) The technical basis for either inclusion or exclusion of specific, naturally occurring and human-induced hazards in the safety analysis;

c. Further guidance regarding the identification and evaluation of potential event sequences is provided in the NRC Yucca Mountain Review Plan (NUREG-1804, Revision 2) on pages 2.1-25 and -26 as follows:

2.1.1.4 Identification of Event Sequences

Review Method 2 Categories 1 and 2 Event Sequences

Verify that the U.S. Department of Energy has properly considered the hazards and initiating events reviewed . . .

Acceptance Criterion 1 Adequate Technical Basis and Justification are Provided for the Methodology Used and Assumptions Made to Identify Preclosure Safety Analysis Event Sequences

(1) Methods selected for event sequence identification are appropriate, and are consistent with Agency [NRC] guidance or standard industry practices or are adequately justified.

(2) The methods selected are consistent with, and supported by, site-specific data; and

(3) Assumptions made in identifying event sequences are valid and reasonable.

The definition of event sequence in 10 CFR 63.2 is also relevant to this contention as follows.

§ 63.2 Definitions

Event sequence means a series of actions and/or occurrences within the natural and engineered components of a geologic repository operations area that could potentially lead to exposure of individuals to radiation. An event sequence includes one or more initiating events and associated combinations of repository system component failures, including those produced by the action or inaction of operating personnel. Those event sequences that are expected to occur one or more times before permanent closure of the geologic repository operations area are referred to as Category 1 event sequences. Other event sequences that have at least one chance in 10,000 of occurring before permanent closure are referred to as Category 2 event sequences.

5. Statement of Alleged Facts or Opinions and References to be Relied On (2.309(f)(1)(vi))

a. DOE is required to perform a preclosure safety analysis of the geologic repository operations area that must include an identification and systematic analysis of naturally occurring and human-induced hazards at the geologic repository operations area, including a comprehensive identification of potential event sequences (10 CFR 63.112 (b)). Additionally, DOE must provide the data used to identify naturally occurring and human-induced hazards at the geologic repository operations area (10 CFR 63.112 (c)). It must further provide the technical basis for either the inclusion or exclusion of specific, naturally occurring and human-induced hazards in the safety analysis (10 CFR 63.112 (d)). This technical basis must be implemented by the determination of potential event sequences that result in release of and public exposure to radioactive contaminates that could occur during repository operations and determining the probability of such event sequences. If the event sequences are such that they could occur with a probability of at least one chance in 10,000 over the period of preclosure repository operations, DOE must prepare consequence calculations and compare those calculated consequences to prescribed standards in 10 CFR 63.111(b)(2).

b. Contrary to these requirements, DOE has failed to provide any justification or basis for its assumption that it can achieve a binding agreement with the USAF to prescribe flight restrictions on its operations in the vicinity of the repository. DOE merely makes the unsupported assumption that, "The accident analysis conducted assumed that such flight restrictions would occur." Without the flight restrictions assumed by DOE, its calculation of aircraft crash event sequence probability would likely have significantly different results. Based on the assumption and its prominence in SAR section 1.6.4.3.1 and in Bectel SAIC Company (BSC) calculation, "Frequency Analysis of Aircraft Hazards for License Application," page 22 (BSC identifier 000-00C-WHS0-00200-000-00E and DOE LSN

Participant Accession Number ALOA.20071023.0985), it is presumed that without the unjustified assumption that an aircraft crash into repository facilities would be much more probable and categorized as a category 2 event sequence per 10 CFR 63.2. The consequences of such an aircraft crash are unknown because DOE has not performed a consequence analysis using NRC regulated processes because of its claim that the probability of such an event sequence is below the regulatory probability threshold for category 2 event sequences.

c. Nye County believes that before NRC allows DOE to begin construction of the repository, it should require a binding agreement between DOE and the USAF mandating the flight restrictions assumed by DOE in its preclosure safety analysis. At a minimum, DOE should be required to provide justification and basis for its assumption showing that there is reasonable assurance, such as documentation from the USAF, that such an agreement with the USAF is forthcoming with a prescribed implementation date or milestone. NRC should also make ongoing flight restrictions as assumed in DOE's safety analysis a condition of any license it issues for DOE to receive and possess nuclear materials at the repository. Otherwise, it is unknown whether or not the USAF would implement such restrictions and DOE's safety analysis is without basis in regard to the aircraft crash event sequence categorization. Such an indeterminate state is not adequate to show that repository workers and other Nye County residents in the vicinity of the repository will be safe.

6. References (including relevant LA sections)

Yucca Mountain Repository License Application, General Information and Safety Analysis Report. DOE/RW-0573 REV 0. 2008 (SAR Section 1.6.3.4.1, pp. 1.6-21, 6-22, and 6-23, Section 5.7; SAR pp 5.7-1 to 5.7-55). LSN DEN001592183

NRC "Yucca Mountain Review Plan," pp. 2.1-25 and -26 (NUREG-1804, Revision 2)

Bechtel SAIC Company calculation, "Frequency Analysis of Aircraft Hazards for License Application," page 22 (BSC identifier 000-00C-WHS0-00200-000-00E and DOE LSN Participant Accession Number ALA.20071023.0985)

10 CFR 63.2

10 CFR 63.111 (b), (c)

10 CFR 112 (a), (b), (d)

7. Statement Regarding Joint Ownership

Nye County is jointly sponsoring this Safety Contention with the Nevada Counties of Churchill, Esmeralda, Lander, and Mineral, and Inyo County, California.

December 19, 2008

United States Of America Nuclear Regulatory Commission
High Level Waste Application

In the Matter of	)	
	)	Docket No. 63-001
U.S. DEPARTMENT OF ENERGY	)	
	)	
(High-Level Waste Repository:	)	
High-Level Waste Application)	)	
	)	

NEVADA COUNTIES OF CHURCHILL, ESMERALDA, LANDER AND MINERAL

Certificate of Service

I hereby certify that the foregoing "The Nevada Counties of Churchill, Esmeralda, Lander and Mineral Petition to Intervene" was served this date via the Nuclear Regulatory Commission's Electronic Information Exchange ("EIE"), which to the best of my knowledge transmitted the foregoing upon those on the Service List maintained by the EIE for the above-captioned proceeding.

Respectfully submitted

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Dated in Las Vegas, Nevada
This 19th day of December 2008