Draft NUREG-2125 Public Comment Resolution Report

Resolution Table for Public Comments Received on
NUREG-2125, Draft Report for Comment [ML12125A218]

The availability of Draft NUREG-2125 for Comment was announced in the Federal Register on May 14, 2012 with a 60-day comment period that closed on July 13, 2012. Four comment letters were received. The comment letters are available in ADAMS [ADAMS Accession Number in brackets]:

1. Nevada Agency for Nuclear Projects (NV/ANP) [ML12202A637]
2. Nuclear Energy Institute (NEI) [ML12194A473]
3. Oregon Department of Energy (OR/DE) [ML12198A288]
4. Western Interstate Energy Board (WIEB) [ML12200A033]

The four comment letters contained a total of 94 comments that are listed in separate rows in the Table below. The Table provides a comment response, and also identifies what changes, if any, were made to Draft NUREG-2125 as a result of the comment. Note that many of the comments did not pertain to NUREG-2125 directly, or did not require any change to NUREG-2125; no changes to Draft NUREG-2125 were made as a result of these comments. The final version of NUREG-2125 that incorporates the changes shown in this table is available from the NRC.

Commenter	Comment Number	Comment	Response	Change(s) made to Draft NUREG-2125
NV/ANP	1	**Inadequate Time for Public Review and Comment** The 60-day comment period is inadequate for the following reasons: The length of the report (509 pages), the scope of the report, and the technical complexity of the subject matter justify a longer comment period of at least 90 days and, preferably, 120 days. Specific technical issues, such as 1) the selection of shipping cask designs for analysis (and the decision not to include two currently licensed casks, the NAC LWT and the IF-300); 2) assumptions about spent fuel bum up history and cooling time; 3) selection of origin-destination pairs, routes, and buffer distances used for routine dose and accident risk analyses; and 4) consequence analyses for transportation accidents resulting in release of radioactive materials, have required that our agency contract with an outside technical reviewer to assist us in preparing our comments. The subject report references in its bibliography, but apparently does not actually include in its analyses, a number of recent NRC-sponsored studies of transportation accidents involving long-duration, high-temperature fires. This will require additional time to evaluate possible contradictions between those NRC studies and the findings of NUREG-2125. The comment period announced in the Federal Register notice, from May 14 to July 13, included two major Federal holidays - Memorial Day on Monday, May 28 and Independence Day on Wednesday, July 4 - which fell on what would otherwise have been normal work days, effectively reducing the time for review by 2-10 days. The NRC denial of Nevada's request for an extension contrasts with the NRC decision to grant a 14-day extension (to 60 days total) for review of a 138-page draft report, "Identification and Prioritization of the Technical Information Needs Affecting Potential Regulation of Extended Storage and Transportation of Spent Nuclear Fuel," (May 2012). In February 2012, the NRC granted a 31-day extension (to 90 days total) for review of a 23-page draft report, "Background and Preliminary Assumptions for an Environmental Impact statement - Long-Term Waste Confidence Update," (December 2011). (See http://www.nrc.gov/waste/spent-fuelstorage/public-invovement.html) *Please explain why extensions were granted for review of these draft reports, which were much shorter and, in our opinion, much less technically complex than NUREG-2125.*	The staff did not consider the draft reports mentioned in establishing the 60-day comment period for Draft NUREG-2125. The 60-day period was considered adequate considering the length and complexity of Draft NUREG-2125.	None.

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NV/ANP	2	In denying Nevada's request for a 60-day extension, NRC cited the scheduling of a review of NUREG-2125 at the Advisory Committee on Reactor Safeguards (ACRS) meeting on September 5,2012. The ACRS meeting is scheduled to occur 54 days after the July l3 comment deadline. *Please explain why NRC did not grant an extension of, at a minimum, 30 days, or even 45 days.*	The extension was not approved because the original 60-day period was considered adequate.	None.
NV/ANP	3	Please assist us in understanding how the original 60-day comment period was established by answering the following questions: *When did the concept for this project originate?*	Project concept originated in early 2005.	None.
NV/ANP	4	*When did the contractors at Sandia National Laboratories begin work on this project?*	Contract work began in May 2006.	None.
NV/ANP	5	*When did the peer review occur, and how long was the peer review period?*	Peer review began in Aug. 2010 and was completed over a period of 16 months, including review of two different drafts of the document.	None.
NV/ANP	6	*What was the total budget for this project, including peer review?*	Total project budget was about $2M, including peer review.	None.
NV/ANP	7	*What efforts were made by NRC and Sandia to solicit stakeholder comment on this project, prior to publication of the draft report in May 2012?*	Development of the project plan for SFTRA included consideration of comments on Reexamination of Spent Fuel Shipment Risk Estimates (NUREG/CR-6672), that were provided after its publication in March of 2000, and input gathered on topics not related to physical testing during the public meetings on the Package Performance Study in March of 2003 located in Rockville, MD, Las Vegas and Pahrump, NV, and Rosemont, IL.	None.
NV/ANP	8	**Potential Implications of NUREG-2125 for NRC Licensing Proceedings** Finalization of Draft Report NUREG-2125 will likely have significant implications for the evaluation of transportation impacts in future NRC licensing proceedings for interim storage facilities and geologic disposal facilities. NRC administrative law judges have already established the ground rules for evaluation of transportation impacts under the National Environmental Policy Act (NEPA) in the currently suspended licensing proceeding for the proposed Yucca Mountain repository: Transportation of nuclear waste is a foreseeable consequence of constructing a nuclear waste repository. As California persuasively argues, "[w]ithout transportation of the waste to it, Yucca Mountain would be just a very large, fancy, and expensive hole in a mountain." The Commission, for example, has stated that there can be "no serious dispute" that the NRC's environmental analysis in connection with licensing nuclear facilities should extend to "related offsite	One of the possible uses of NUREG-2125 is to provide information for future transportation environmental assessments. NUREG-2125 is a generic, technical study of potential radiological impacts from spent fuel transport under routine and accident conditions. It is not an environmental impact assessment for any specific facility. Like its predecessor generic risk studies, NUREG-2125 may be used to support environmental assessments for a wide variety of transportation campaigns. Draft NUREG-2125 did not consider or assess SNF shipments to Yucca Mountain. However, the results (lower release fractions, less loss of shielding, lower accident rates, updated event trees) from Draft NUREG-2125 indicate the FEIS is conservative (that is, overstates risk estimates) with respect to potential accident impacts. The results for routine transport are	None.

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		construction projects - such as connecting roads and railroad spurs." Likewise, there can be no serious dispute that the NRC's NEPA responsibilities do not end at the boundaries of the proposed repository, but rather extend to the transportation of nuclear waste to the repository. The two are closely interdependent. Without the repository, waste would not be transported to Yucca Mountain. Without transportation of waste to it, construction of the repository would be irrational. Under NEPA, both must be considered. 1 I NRC, Atomic Safety and Licensing Boards, Memorandum and Order Identifying Participants and Admitted Contentions, Docket NO. 63-00I -HLW (May 1],2009). As part of the Yucca Mountain licensing process, NRC staff reviewed and adopted the 2008 U.S. Department of Energy (DOE) Final Supplemental Environmental Impact Statement (FSEIS) for Yucca Mountain (DOEIEIS-0250F), including the transportation impact calculations for the mostly rail transportation scenario.2 The Draft Report makes no reference to the 2008 DOE FSEIS, although it cites DOE's earlier 2002 EIS. *As part of its finalization of Draft Report NUREG-2125, NRC staff must assess the implications of the findings and conclusions of the Draft Report for the FSEIS transportation impact calculations adopted by NRC staff in the Yucca Mountain licensing proceeding*. The DOE FSEIS adopted by NRC staff evaluated radiological impacts in three categories related to routine transportation and transportation accidents: (1) "incident-free" exposures to members of the public residing near transportation routes, cumulative total up to 2,500 person-rem dose and 1.5 latent cancer fatalities, and in certain special circumstances (for example, 0.016 rem to a person in a traffic jam); [FSEIS, Pp.6-20, 6-21, 8-41] (2) "incident-free" exposures to transportation workers such as escorts, truck drivers, & inspectors, cumulative total up to 13,000 person-rem and 7.6 latent cancer fatalities (by administrative controls, DOE would limit individual doses to 0.5 rem per year; the allowable occupational dose is 5 rem per year); [FSEIS, Pp.6-21, 8-41] and (3) release of radioactive material as a result of the maximum reasonably foreseeable transportation accident (probability about 5 in one million per year), involving a fully engulfing fire, 34 rem dose to the maximally exposed individual, 16,000 person-rem population dose and 9.4 latent cancer fatalities in an urban area, and cleanup-costs of $300,000 to $10 billion. [FSEIS, Pp.6-15, 6-24, G-56]	similar in the two risk assessments. Therefore, the general conclusions of the FEIS are consistent with the results of Draft NUREG-2125. The implications of Draft NUREG-2125 to other ongoing or future NRC actions is beyond the scope of this activity, but should be addressed by the activities supporting those actions. In the event that the Yucca Mountain licensing proceedings resume, the NRC would take into consideration any new information concerning transportation, including the SFTRA, as it continues the next steps of the formal EIS adoption process (the licensing proceedings).	

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NV/ANP	9	**Significance of National Transportation Impacts** *The Draft Reports fails to adequately assess the national impacts of spent fuel transportation from the current 72 reactor sites to one or more storage and/or disposal facilities.* The highway and rail route maps presented in the Draft Report (Pp. 23-26) traverse more than 30 states. A complete routing analysis of all origin-destination pairs would likely demonstrate more widespread impacts similar to those identified in studies prepared for the State of Nevada. These Nevada studies, which are not referenced in the Draft Report, concluded that an extraordinary number of people, communities, and political jurisdictions would have been impacted by shipments to the proposed Yucca Mountain repository. Most of the nation's spent fuel and high level waste is currently stored at 72 reactor sites and 4 DOE sites in 34 states. The "representative routes" identified by DOE in the FSEIS, from these sites to Yucca Mountain, would have utilized 22,000 miles of railways and 7,000 miles of highways traversing 44 states. (Attachment 1) An updated report, using 2010 census data, found that the representative routes would have traversed 955 counties with a total population of more than 177,000,000. About 56 percent of the total US population resides in counties that would have been traversed by spent fuel and high-level waste shipments to Yucca Mountain. (Attachment 2)	Draft NUREG-2125 is an estimate of the potential radiological impact of SNF transport under routine and accident conditions. It was never the intent of Draft NUREG-2125 to include analysis of all possible reactor site and disposal facility combinations. The staff believes the routes used are adequate to be representative of such shipments; comparisons with SNF transport impacts from previous NRC studies completed over the last 35 years are provided.	None.

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NV/ANP	10	**Sweeping Conclusions Unsupported by the Analyses** The Draft Report contains a number of sweeping conclusions that are not supported by the analyses presented in the document. For example, the Draft Report concludes that the collective radiological doses from spent fuel transportation are "vanishingly small" (Pp. xxii, 128, 139, F11). This conclusion is based on the analysis of the movement of a single spent fuel cask from four different sites to four different destinations. The report states that its findings are meant to be applied to "a large scale shipping campaign." (Pp.l0, 13) *From this miniscule sample, the report claims its findings can be extrapolated to future shipping campaigns. This conclusion is not supported by the evidence presented by the report.*	NUREG-0170, the environmental impact statement for all radioactive material transport, (not just spent fuel) by all modes, used a single standard shipment model to assess impacts. Draft NUREG-2125's road and rail routes span many states and thousands of miles through rural, suburban, and urban areas across the country. These thousands of miles are adequate to represent other routes. The staff believes the routes used are representative of SNF shipment routes; that the doses for the included routes are similar; inclusion of additional routes would not change the conclusions, which are supported by the analyses. The use of "vanishingly small" on pages xxii, 139, and F11 refers to the comparison of collective dose from transportation, which is four to five orders of magnitude less than these people receive from background during the time of the transportation. The use of the term on page 128 refers to the collective dose risk from accidents involving release or loss of gamma shielding, which are 8 orders of magnitude lower than the doses from routine transportation. These results are supported by the corresponding analyses. However, in consideration of this comment the term "vanishingly" will be replaced by "very".	Replaced the term "vanishingly small" with "very small" in all instances.
NV/ANP	11	**Cask Designs Chosen for Analysis** Among the cask designs chosen for analysis in the Draft Report were the GA-4 truck cask, the NAC-STC rail cask, and the HI-STAR 100 rail cask. (Pp.9-13) It is our understanding that these casks have been used for few, or any, spent fuel shipments in the United States. Please answer the following questions about these casks: *How many GA-4 truck casks are currently being used in the United States?*	It is true that few GA-4, NAC-STC, or HI-STAR 100 casks are in use today. However, NUREG-2125 is intended to be forward looking and the casks chosen are those that are likely to be used in any future large-scale transportation campaigns. For this reason, NRC did not assess low-capacity or no longer certified casks, such as the NAC-LWT or IF-300. NRC does not require its licensees to supply usage data, but there have been no GA-4 casks fabricated.	None.
NV/ANP	12	*How many shipments of spent fuel in the United States have been made in GA-4 casks?*	None	None.
NV/ANP	13	*How many NAC-STC rail casks are currently being used in the United States?*	Two NAC-STC casks have been fabricated and they are being used oversees. There are no NAC-STC casks currently being used in the US.	None.
NV/ANP	14	*How many shipments of spent fuel in the United States have been made in NAC-STC casks?*	None	None.

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NV/ANP	15	*How many HI-STAR 100 rail casks are currently being used in the United States?*	NRC does not maintain data on package fleets, but there are several HI-STAR 100 casks (which are certified under both part 71 and part 72) loaded with spent fuel and being used for storage.	None.
NV/ANP	16	*How many shipments of spent fuel in the United States have been made in HI-STAR 100 casks?*	None	None.
NV/ANP	17	*If the purpose of the report is to assess the adequacy of the existing NRC regulations, why did NRC decide to perform detailed analysis of these three casks, which have been used for few, if any, spent fuel shipments in the United States, under the existing regulations?*	Cask selection details are provided in Section 1.5. Casks were selected in 2006 primarily on the basis of certified designs believed likely to be used in future spent fuel shipping campaigns, as discussed in Section 1.5. The staff believes the casks selected are appropriate for the purpose of the study.	None.
NV/ANP	18	**Cask Designs Not Chosen for Analysis** Among the cask designs not chosen for analysis in the Draft Report were the NAC LWT truck cask and the IF-300 rail cask. (Pp. 9-13) It is our understanding that these are the two casks that were used for the majority of spent nuclear fuel shipments in the United States over the past two decades. It is also our understanding, based on previous studies, that the performance of these casks in severe accidents involving fires could be significantly different than the casks selected for analysis. It is also our understanding that there have been a number of incidents involving human error in the fabrication and loading of these casks. Please answer the following questions about these casks: *How many NAC LWT truck casks are currently being used in the United States?*	NRC does not maintain data on package fleets, but NAC has advised that there are 8 of these casks in use.	None.
NV/ANP	19	*How many shipments of spent fuel in the United States have been made in NAC LWT casks since 1990?*	NRC does not maintain cask usage data. According to NAC International, the LWT cask has been used for 15 shipments of commercial spent nuclear fuel. None of these shipments was of an entire assembly. The NAC-LWT was not chosen for this study because of its low capacity.	None.
NV/ANP	20	*How many IF-300 rail casks are currently being used in the United States?*	None, this cask has not been certified since 2005 and was therefore not considered for NUREG-2125.	None.
NV/ANP	21	*How many shipments of spent fuel in the United States have been made in IF-300 casks since 1990?*	NRC does not maintain cask usage data, but this cask was used extensively throughout the 1990s and early 2000s.	None.

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NV/ANP	22	*Have any previous studies known to the NRC evaluated the performance of NAC LWT truck casks in severe accidents involving long-duration, high-temperature fires?*	Yes. There are several papers and reports that summarize the results from such analyses. Some of these are: - A PATRAM 2001 paper on Pipeline fires by Lopez et al. - An INMM paper at the 45th Annual meeting (2004) on small long-duration fires by Greiner et al. - A PATRAM 2004 paper on tunnel fires by Lopez et al. - The Baltimore and Caldecott tunnel fire NUREG/CRs	None
NV/ANP	23	*How do these studies compare to the findings reported in the Draft Report?*	The first three papers mentioned above support the results/conclusions presented in this Draft NUREG. All five reports indicate the containment response of the NAC-LWT is not significantly different than that of the GA-4.	None
NV/ANP	24	*Have any previous studies known to the NRC evaluated the performance of IF-300 truck casks in severe accidents involving long-duration, high-temperature fires?*	We are not aware of any evaluations of the IF-300 for extra-regulatory fire accidents.	None
NV/ANP	25	*How do these studies compare to the findings reported in the Draft Report?*	N/A	None
NV/ANP	26	*Have any previous studies known to the NRC evaluated human errors involving fabrication and loading of NAC LWT truck casks used for spent fuel shipments in the United States?*	The staff is not aware of any reported incidents specifically caused by human error involving the NAC-LWT	None
NV/ANP	27	*Did any reported human error incidents result in NRC enforcement actions?*	No	None
NV/ANP	28	*Have any previous studies known to the NRC evaluated human errors involving fabrication and loading of IF-300 rail casks used for spent fuel shipments in the United States?*	The staff is not aware of any reported incidents specifically caused by human error involving the IF-300.	None
NV/ANP	29	*Did any reported human error incidents result in NRC enforcement actions?*	No	None
NV/ANP	30	*If the purpose of the report is to assess the adequacy of the existing NRC regulations, why did NRC decide not to perform detailed analysis of the casks which are actually being used for spent fuel shipments at the present time, under the existing regulations?*	Cask selection details are provided in Section 1.5. Casks were selected in 2006 primarily on the basis of certified designs believed likely to be used in future spent fuel shipping campaigns, as discussed in Section 1.5. The staff believes the casks selected are appropriate for the purpose of the study. (See response to comment 17)	None.

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NV/ANP	31	*Is the NRC aware of any regulation which would prohibit the use of NAC LWT and IF-300 casks for future shipments to an interim storage facility or geologic repository?*	The NRC Certificate of Compliance (CoC) for the IF-300 expired in 2005 and cannot be renewed. Therefore, the use of this package for the transportation of spent nuclear fuel is not permitted. The NAC-LWT could be used for future shipments, but the low capacity of this cask (1 PWR or 2 BWR assemblies) makes it unlikely that it will be used a part of a major shipping campaign.	None.
NV/ANP	32a	**Full-Scale Cask Testing** *It is our understanding that none of the spent fuel shipping casks currently in use in the United States has been tested full-scale to confirm their performance in regulatory or extra-regulatory accidents. (Attachment 3) Is this correct?*	The staff agrees with the comment.	None.
NV/ANP	32b	*Has any of the computer models used for dynamic finite element calculations of the NAC-STC and HI-STAR 100 rail casks in the Draft Report been validated or bench marked with results from full-scale testing of casks currently in use in the United States?*	There has been no full-scale testing of the casks currently in use in the United States, or of the casks used in this study. The PRESTO code used to determine the response of the rail-lead and rail-steel casks has been extensively benchmarked against test results for a wide variety of problem types that utilize the same features of the code that are needed to determine the response of the casks. In addition, this code is very similar to other explicit dynamic codes, for which there is a large literature base of comparison between cask test and analysis results, including a comparison between analyses and full-scale testing. Of more importance than the size of the model being compared is the amount of deformation in package being compared. In the amendment to the PAT-1 certification, finite element models similar to those used in this study were used to predict the response of this package to high-speed impacts. The results of these analyses were compared to the results from the physical tests used in the original certification of the package.	Added this to the report in Section 3.2: The results from analyses using this type of code have been compared to results from both regulatory and high-speed impact tests. A recent Safety Analysis Report Addendum for the PAT-1 air transport package compared the very large deformations seen in full-scale testing of this package to those calculated using nonlinear explicit dynamics (Yoshimura et al., 2010). There have also been comparisons between full-scale regulatory drop tests of two spent fuel casks in Germany with explicit dynamic finite element analyses (Junichi Kishimoto et al., 2007, Musolff et al., 2007).

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NV/ANP	33	In 2006, the National Academies (NAS) report, Going the Distance?, endorsed full-scale testing of shipping casks under certain conditions. The Draft Report cites this report, but does not address full-scale cask testing. The NAS finding and recommendation are as follows: "FINDING: The committee strongly endorses the use of full-scale testing to determine how packages will perform under both regulatory and credible extra-regulatory conditions. Package testing in the United States and many other countries is carried out using good engineering practices that combine state-of-the-art structural analyses and physical tests to demonstrate containment effectiveness. Full-scale testing is a very effective tool for both guiding and validating analytical engineering models of package performance and for demonstrating the compliance of package designs with performance requirements. However, deliberate full-scale testing of packages to destruction through the application of forces that substantially exceed credible accident conditions would be marginally informative and is not justified given the considerable costs for package acquisitions that such testing would require. RECOMMENDATION: Full-scale package testing should continue to be used as part of integrated analytical, computer simulation, scale model, and testing programs to validate the performance of package performance. Deliberate full-scale testing of packages to destruction should not be carried out as part of this integrated analysis or for compliance demonstrations." *Why did NRC decide not address full-scale testing as proposed by the NAS in the Draft Report?*	Physical testing was explicitly excluded from the scope of SFTRA and precluded by the limited resources of SFTRA. At the time that SFTRA was initiated, the NRC Package Performance Study was addressing the full-scale testing issue.	None.
NV/ANP	34	*How might the findings of the Draft Report be used to support full-scale cask testing as proposed by the 2006 NAS report?*	Draft NUREG-2125 results show either low or no expectation of radioactive material release even in the event of extremely severe spent fuel shipment accident conditions that substantially exceed credible accident conditions. This result supports the NAS finding that “deliberate full-scale testing of packages to destruction through the application of forces that substantially exceed credible accident conditions would be marginally informative and is not justified given the considerable costs for package acquisitions that such testing would require.” The results of Draft NUREG-2125 indicate the current regulatory practices of the NRC provide sufficient level of safety, and no change is needed, including a requirement for full-scale testing.	None.

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NV/ANP	35	In 1999, NRC began the process of developing a cask testing demonstration study as part of the Package Performance Study (PPS). The most recent NRC testing proposal (SECY-05-00l), approved by the Commission in June 2005, calls for a demonstration test in which a cask mounted on a railcar is impacted by a speeding locomotive, and then subjected to a 30-minute fire engulfing fire. "The staff's proposed test plan as provided in this SECY is not the final word on this issue, as the project is subject to additional modifications and Commission direction once additional information becomes available." Nevada believes the test proposed in SRM SECY-05-0051 would not determine if the rail cask meets the accident performance standards set forth in the NRC regulations and would provide little data useful for validating the computer models used in safety evaluations. The demonstration test appears to have the same limits noted by NRC staff regarding the tests proposed in 2004. However, Commission stated that this plan "is not the last word of this issue." *Why did NRC decide not address full-scale testing as proposed in SRM SECY -05-0051 in the Draft Report?*	Physical testing was explicitly excluded from the scope of SFTRA and precluded by the limited resources of SFTRA. At the time that SFTRA was initiated, the NRC Package Performance Study was addressing the full-scale testing issue, and was the subject of SECY-05-0051. The NRC Advisory Committee on Nuclear Waste reviewed the proposal of SRM SECY-05-0051 and concluded "The ACNW has not seen any compelling science-based justification for the proposed test. In the Committee's opinion the proposed demonstration will add little new information of technical value. If a full-scale demonstration is deemed necessary, it should be justified on grounds other than technical needs."	None.
NV/ANP	36	*How might the findings of the Draft Report be used to support full-scale cask testing as proposed in SECY-05-0051?*	Draft NUREG-2125 results show either low or no expectation of radioactive material release even in the event of extremely severe spent fuel shipment accident conditions. The results do not support the need for full-scale testing as proposed in SECY-05-0051.	None.
NV/ANP	37	**Insufficient Detail to Allow Independent Confirmation of Findings** In a number of important instances, the Draft Report does not sufficient data to confirm its findings. For example, regarding the routes evaluated, it provides only national maps of the routes studied, rather than the detailed printouts from the WEBTRAGIS software that would have permitted detailed confirmation of the routes shown in the maps. The *WEBTRAGIS outputs for each of the routes evaluated should be included in the final version.* Moreover, it is difficult to confirm the population data used in the Draft Report. Nevada submits an alternative approach to assessment of population data along potential shipping routes at the national level (Attachment 4) and at the state and county level (Attachment 5).	We will create a WebTRAGIS results document that will be posted in ADAMS.	Added a reference to the WebTRAGIS output files in ADAMS following Table 2-5. The WebTRAGIS output files will be posted in ADAMS.

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NV/ANP	38	**Routine Dose Calculations for Truck Shipments Ignore Over-weight Truck Operations and Traffic Gridlock Incidents** *The Draft Report routine dose calculations for truck shipments must be completely re-evaluated. The Draft Report assumes that the GA-4 can be shipped as a legal-weight cask. In the 2008 FSEIS, DOE determined that the GA-4 (and GA-9) casks would need to be transported as overweight truck shipments. As a result, the report's results are incomplete, misleading and tentative at best.*	The GA-4 cask was designed to be transportable as legal weight truck. Whether or not any particular shipping campaign chooses to transport this cask as legal weight or overweight must be addressed within the campaign specific environmental assessment. It is expected that all of the logistics of a major transportation campaign will be addressed by the entity performing the transportation. The time required to complete the necessary overweight truck permitting activities is included in the time for the inspection stop at each state border. The dose results do not change if the truck were overweight.	None
NV/ANP	39	*The Draft Report completely ignores the potential dose to members of the public resulting transportation gridlock incidents during truck shipments.*	The draft report considers gridlock in the urban rush hour calculations. The specific values that are used in the urban rush hour calculations are a 50% reduction in the average speed and a 100% increase in the traffic density. NRC believes that on average, these values incorporate the effect of gridlock.	Added the term “gridlock” when describing the urban rush hour analyses in the footnote to Table 2-7
NV/ANP	40	**Routine Dose Calculations for Rail Shipments Ignore Intermodal Transfers and New Security Regulations** *The Draft Report routine dose calculations for rail shipments must be completely re-evaluated. The Draft Report ignores the fact that about one-third of the current 72 reactor sites cannot make direct rail shipments. Many sites once thought to have rail access, no longer do. Previous examinations of this problem by DOE have found that it will be necessary to use a mix of barge, overweight and heavy trucks to move spent fuel in rail casks to the nearest railhead. The Draft Report ignores past shipping plans which envisioned heavy haul truck, barge, intermodal and overweight truck as all being necessary to ship these materials, and fails to considers potentially lengthy delays due to normal traffic congestion, rail incidents, equipment failure or other causes. Moreover, the Draft Report completely fails to consider the new rail security regulations adopted by the Federal Railroad Administration and the Department of Homeland Security in 2008. These new regulations will dramatically affect routing decisions and create significantly increased stop time for routine rail shipments, even if all shipments are assumed to be made in dedicated trains. These issues regarding rail shipments are addressed in detail in Attachment 1.*	Previous NRC risk studies have not included site specific transport issues such as heavy-haul trucks or intermodal transfer. Draft NUREG-2125’s routine transportation scenarios have been kept similar to facilitate comparison. It is expected that the logistics of a major transportation campaign will be addressed by the entity performing the transportation. Draft NUREG-2125 does not consider intermodal transport of the rail casks (either as heavy-haul truck or barge). If this action were needed within a transportation campaign, it would be the responsibility of the planners to incorporate these activities. Similarly, the 2008 security regulations require a risk analysis of alternative routes, which will increase the amount of planning required prior to the shipment, but the actual route choices are limited, and the final routes chosen may or may not be the same as those analyzed in this report. Draft NUREG-2125 provides information for the transportation planners to consider in conducting the requisite risk study. The average rural and suburban rail speed used is 40 kph and for urban segments 24 kph is used. This takes into account delays caused by a variety of factors.	None

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NV/ANP	41	**Accident Scenarios Underestimate Potential Fire Durations and Temperatures** *Nevada believes that the Draft Report underestimates the potential fire durations and fire temperatures to which casks may be exposed in transportation accidents.*	The probability, given an accident, of the most severe fire considered in Draft NUREG-2125 is 10^{-14} as explained in Section E.3.1.2. While it is possible to envision a more severe fire accident; such events would have an even lower probability and would need to result in a release of more than 1000 A_2 in order to affect the overall risk of spent fuel transportation.	None
NV/ANP	42	The NAS 2006 report underscored the importance of assessing and managing the radiological risks from "releases in extreme accidents involving very long duration, fully engulfing fires. While the likelihood of such extreme accidents appears to be very small, their occurrence cannot be ruled out based on historical accident data for other types of hazardous material shipments." The NAS recommended a combination of administrative controls, route-specific risk analyses, studies of real-world accident conditions, computer analyses of cask performance, and full-scale testing to address these risks. (Pp. 10-15) The NRC has prepared a number of studies since 2006 that implement some of the NAS recommendations, particularly studies of specific accidents such as the 2001 Baltimore Tunnel rail fire and the 2007 MacArthur Maze highway fire. *The Draft Report specification of accident fire scenarios raises questions about how the authors considered and incorporated the findings of other NRC reports, particularly regarding the Baltimore Tunnel rail fire and the MacArthur Maze highway fire.*	The regulations in 10 CFR Part 71 allow for the potential of a release from a package that encounters the Hypothetical Accident Conditions (HAC) described in Section 73 of the regulation cited above. The allowable release from a package after experiencing accident conditions is described in Section 71.51. The NRC's analyses of Caldecott and Baltimore Tunnel fires show either no or only a small release of radioactive material, well within the release allowed by the regulations and less than that calculated for the most severe impact analyses of this report. As indicated by the work of the NRC over the past decade examining historic severe, long duration fire accidents and their potential impacts on SNF transportation packages, the staff acknowledges that there are clearly accident scenarios that could be postulated that fall outside of the HAC fire described in 10CFR71.73, and that the potential for a release from a package cannot be ruled out given exposure to such an "extra-regulatory" scenario; however; because an accident that produces a fire exposure sufficient to cause release is so improbable, it has little impact in the overall risk of SNF shipments.	Added to Section 5.5.4: The NRC has conducted several analyses of historic fire accidents making conservative assumptions regarding the placement of a cask within those fires (Adkins et al., 2006; Adkins et al., 2007, and Bajwa et al., 2012).Consider first the railroad tunnel fire event similar to the Baltimore Tunnel Fire (Adkins et al., 2006) (the consequence of the truck tunnel fire was three hundred times lower). Based on the rail event tree and the fire branch from Appendix E, the conditional probability that a pool fire occurs in a tunnel is $7x10^{-9}$. For this event to be as severe as that analyzed, the car carrying flammable liquid would need to be only one car away from the car carrying the spent fuel cask (DOT regulations require a buffer car between a spent fuel car and other freight). If we assume the train consist is formed randomly, the probability that the closest car to the cask car is carrying flammable hazardous material is 0.055 (from DOT, 2010). Combining these two probabilities gives a net conditional probability of a pool fire in a tunnel as close as possible to a cask of $4x10^{-10}$. This probability does not include any information about the duration of that pool fire, but if it is assumed that all of these types of fires are as severe as the Baltimore Tunnel Fire, this number can be used to estimate the effect on the transportation risk assessment. Adkins et al. conservatively estimated this fire could cause a release of 0.3 A_2 of material from a rail cask without inner welded canister. This compares to the impact release of 8.4 A_2 with the same probability. Therefore, even with the conservative assumptions about the amount of release and the severity of the fire,

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				including tunnel fires will only increase the accident collective dose risk by 4%. The MacArthur Maze highway fire (Bajwa et al., 2012) may lead to a release of radioactive material. The truck event tree in Appendix E does not provide sufficient data to determine the probability of this event, so investigation of the historical accident record is required. In the past twenty years there have been two fires similar to this one, so that provides a starting point. There are about 400,000 large truck accidents each year (DOT, 2008, Table 2-23), so the probability that a severe tanker truck fire occurs below a bridge is approximately $3x10^{-7}$. Neither of these two accidents involved another truck, which would be necessary for a spent fuel cask to be involved in the accident. From the truck event tree in Appendix E, the conditional probability of a collision with a gasoline tanker is $2.5x10^{-3}$. Combining these two probabilities gives the conditional probability that a truck carrying a spent fuel cask is involved in a MacArthur Maze type event is $6x10^{-10}$. For this event to cause a release, the spent fuel cask must also be co-located with the fire and not protected by intervening structure (such as the tractor, the truck bed, or the gasoline tanker). There is no statistical data to provide an estimate for this probability, but it is likely to be less than 0.05. Therefore, the probability of a fire such as that analyzed in Bajwa et al. (2012) is less than $3x10^{-11}$, a factor of 17 less probable than the impact accident that results in an 8.4 A_2 release. Therefore, this type of accident would not change the results of this study in less it resulted in more than 140 A_2 of release.
NV/ANP	43	*Underestimation of fire durations and temperatures challenge the Draft Report conclusion: "Probable worst-case fire accident scenarios for a rail cask transported by railway and for a truck cask transported by roadway were represented within the cases analyzed." (p. 107)*	The term "probable" was included in that sentence because it is not impossible to envision a more severe fire accident; it just has a very low probability. See response to comments 41 and 42.	None

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NV/ANP	44	*Underestimation of fire durations and temperatures also challenge the Draft Report conclusion: "If there were an accident during a spent fuel shipment, there is only about a one in a billion chance that the accident would result in a release of radioactive material." (p. 139)*	The authors recognize that it is not impossible for a more severe fire than those analyzed here, but the probability of such a fire is extremely low. The probability, given an accident, of the most severe fire considered here is 10^{-14}, and the probability of a more severe one is even lower. Therefore, the conclusion "If there were an accident during a spent fuel shipment, there is only about a one in a billion chance that the accident would result in a release of radioactive material" is valid. Also, for spent fuel shipped within inner welded canisters, there is no expectation of release.	None
NV/ANP	45	*Moreover, since the Draft Report did not evaluate the NAC LWT truck cask and the IF-300 rail cask, which are currently used for most spent fuel shipments in the United States, there is no basis for the far-reaching claim in the Draft Report that "the results demonstrate that SNF casks designed to meet current regulations will prevent the loss of radioactive material in realistic severe fire accidents." (p. 107)*	The IF-300 cask is no longer being used because its certificate is no longer valid. The analysis by UNR shows no failure of the NAC-LWT with undamaged impact limiters for fires less than two hours long. This is consistent with the results for the GA-4 cask analyzed in Draft NUREG-2125. This supports the statement quoted in the comment. See also the response to comments 46, 50, and 51.	None
NV/ANP	46	*The cask designs chosen for analysis in the Draft Report were the GA-4 truck cask, the NAC-STC rail cask, and the HI-STAR 100 rail cask. The Draft Report evaluated the responses of the two rail casks to the hypothetical accident fire specified in 10CFR71 (engulfing 30-minute fire at 800°C, 1472°F) and to three variations of an extra-regulatory fire (3 hours at 800°C, 1472°F). The Draft Report evaluated the response of the truck cask to an extra-regulatory fire (1 hour at 800°C, 1472°F). The Draft Report characterizes these combinations of fire conditions and cask damage assumptions as representing "worst-case" scenarios. "The neutron shield material of each cask analyzed was assumed to melt and flow out of the cask instantly at the beginning of the fire." (p. 107) Impact limiters were however "modeled as undamaged (not deformed)." (p. 77)*	Damage to limiters after impact was assumed to be minimal but neutron shield will most likely be damaged by the fire. Sequential accidents are included in the regulatory sequence, but sequential extra-regulatory events are so improbable that including them will not change the risk calculations. In fact the historical accident record has no incidences of an extremely severe impact followed by an extremely severe fire.	Added to Section 4.3.2: Prior analyses of casks comparing the thermal results for regulatory fires with impact limiters damaged from the regulatory impact test vs. undamaged limiters has shown very little effect from including the damage (Lopez and Ammerman, 2004). Damage to impact limiters from an extra-regulatory impact is not considered because of the extremely low probability that an extra-regulatory impact will be followed by a long duration fire.

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NV/ANP	47	*The Draft Report cites the primary NRC study of the Baltimore Tunnel rail fire, NUREG/CR-6886, Revision 2, but it is not clear exactly how the authors used NUREG/CR-6886 in designing their analyses. NUREG/CR-6886, Revision 2, carefully avoided categorizing the Baltimore Tunnel rail fire as a "worst case" tunnel fire accident, describing it as a "a 'beyond design-basis' scenario." (p. 1.9) Building upon previous NRC studies, including a fire study prepared by the National Institute of Standards and Technology (NIST), NUREG/CR-6886, Revision 2, evaluated the performance of three different cask designs subjected to a hypothetical accident based on the conditions estimated to have occurred in the Baltimore tunnel fire, and concluded that there would have been no release of radioactive material from one of the casks (HI-STAR 100), and only minor releases from two other casks (TN-68, and NAC-LWT shipped inside an ISO container). A critical assumption in NUREG/CR-6886, Revision 2, was that the casks could be no closer than 20 meters (66 feet) to the hottest region of the fire, because of FRA regulations governing placement of spent fuel casks in mixed freight trains and because of the geometry of the single track tunnel.* *Based on the Baltimore Tunnel rail fire, Nevada believes that a credible maximum accident fire scenario for a rail cask would be an engulfing fire for 2-3 hours at 800-1,000°C, followed by 3-4 hours at 600-800°C , and at least 24 hours of cool-down.*	NUREG/CR-6886 was not used to design the analyses, and in fact the extensive study of tunnel fires by the NRC prior to Draft NUREG-2125 made it unnecessary to consider this type of event in Draft NUREG-2125. The operating protocols adopted by AAR since the BTF preclude casks being transported by dedicated rail from being involved in a long-duration tunnel fire. For casks transported in regular freight, the FRA regulations force the location of the cask relative to the fire to be no worse than that analyzed in NUREG/CR-6886. The responses of the casks calculated in NUREG/CR-6886 are realistic for the environment studied. None of the casks experienced a large release; even assuming the cask was in the worst possible position. The historic accident study completed by the NRC (NUREG/CR-7034 and -7035) does not conclude that there are any fires that can be fully engulfing and last more than 3 hours. Engulfing fires of 3 hours are considered in Draft NUREG-2125.	None
NV/ANP	48	*While respectful of the methodology and findings of NUREG/CR-6886, Revision 2, there are numerous uncertainties about the calculated fire conditions and possible rail tunnel, track, and train configurations. The Baltimore Tunnel fire was clearly not a "worst case" rail fire, because its duration and temperature were limited by a water main break, tunnel oxygen supply, and other factors. The burning tank car contained enough fuel for a 6-7 hour fire. NUREG/CR-6886, Revision 2, significantly underestimated the potential radiological consequences of the fire by assuming the casks would be located at least 20 meters from the hottest region of the fire. Even at 20 meters distance, the NRC analysis may have underestimated potential radiological consequences for all three casks because of uncertainties in the NIST fire model, assumptions about impact limiter damage, assumptions about SNF cladding performance, and assumptions about release pathways from casks. Administrative controls, in the form of AAR operating protocols for trains carrying spent fuel, are intended to prevent a spent fuel fire accident involving two trains in a single-bore, double-track tunnel.*	We agree that administrative controls, in the form of AAR operating protocols for trains carrying spent fuel, are intended to prevent a spent fuel fire accident involving two trains in a single-bore, double-track tunnel.	None

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NV/ANP	49	*The MacArthur Maze highway fire is still being studied by NRC. However, the fire conditions appear to have been significantly greater than those specified in 10CFR71 or those assumed in the Draft Report for a fire accident involving a truck cask. NRC has estimated that the fire burned for about 17 minutes at 1,100°C (2012°F), followed by 71 minutes at 900°C (1,652°F), followed by a cool-down period. Preliminary results reported by NRC in February 2012, for a spent fuel truck accident assuming a similar fire, suggest that "fuel rods are expected to rupture before the end of the fire." The peak fuel cladding temperature "would almost certainly exceed the short-term limit of 570°C (1058°F), and would likely exceed the zircaloy burst temperature limit of 750°C (1382°F) assumed in previous transportation studies." The NRC analysis assumed that the impact limiters remained intact. (Attachment 6) In finalizing the Draft Report, the results of the MacArthur Maze fire studies must be considered.*	The NRC analysis of the MacArthur Maze fire assumed the fire was large enough to be fully engulfing and that the stated temperatures were uniform throughout the flame envelop, resulting in rod burst and possible cask release. The estimated probability of this event is less than $3x10^{-11}$, given an accident, which is 17 times less probable than the most severe impact accident analyzed. Therefore, including this type of accident in the risk study would not change the results unless it resulted in a release of more than 140 A_2 of material.	Added discussion on MacArthur Maze Fire including its probability and show it does not change the risk numbers. See response to comment 42.
NV/ANP	50	**Accident Scenarios Underestimate Consequences on Damage to Cask Impact Limiters** *Nevada believes that Draft Report underestimates the potential damage to casks in accident fire environments following damage to cask impact limiters.*	The probability of an extra-regulatory fire following an extra-regulatory impact is extremely low and this event is considered to be not credible. In addition, none of the impact analyses investigated in this report led to a loss of the impact limiters. Therefore, it is concluded that the scenarios analyzed in Draft NUREG-2125 do capture the response of the cask in an extra-regulatory environment. See response to comment 51.	None
NV/ANP	51	*The Draft Report evaluates rail and truck cask performance in accident severe fires assuming that the impact limiters are intact. The NRC studies of the Baltimore Tunnel rail fire and the MacArthur Maze highway fire make similar assumptions, although those reports correctly point out the significance of the impact limiter on the lid end of the cask as an important source of thermal insulation for the lid bolts and seals. The attached report by Dr. Miles Greiner uses the CAFÉ-3D fire model to measure the significance of the impact limiter, intact and damaged in different scenarios, relative to the temperatures of concern for the containment seal, for a legal-weight truck cask modeled on the NAC LWT. (Attachment 7) In future efforts to model the performance of both rail and truck casks in long-duration, high-temperature fires, Nevada suggests that the accident fire scenarios include impact limiter damage and/or loss.*	The results shown in Attachment 7 are for casks with and without impact limiters. Damaged (deformed) impact limiters were not analyzed. Results in the INMM paper (damaged impact limiters) show that the damaged limiters will provide protection similar to that of the undamaged limiter, with only a 15°C difference at the interface between the impact limiter and the cask. The difference at the seal region and the spent fuel region would be even less. A simple extrapolation of the results to a 1-hour fire would imply a difference at the seal and spent fuel region of less than 50°C. This change is not enough to cause seal failure and alter the results of this report. While the INMM paper did not address rail casks, engineering principles would suggest the difference would be less.	Included a discussion that damaged impact limiters do not behave significantly different from undamaged ones and the probability of a severe fire following an extra-regulatory impact is extremely improbable. See response to comment 46.

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WIEB	52	*We appreciate the opportunity to review and comment on NRC's "Spent Fuel Transportation Risk Assessment" (SFTRA), issued as NUREG-2125 in May 2012. We also appreciate the special effort of NRC staff to clarify technical questions that arose in our review. We understand that the SFTRA is the third in a sequence of NRC transportation risk assessments, each using somewhat different assumptions regarding cask properties and route environs as well as evolving model assessment tools.*	Previous generic transportation risk studies conducted by the NRC include NUREG-0170 (Final Environmental Statement on the Transportation of Radioactive Material by Air and other Modes, Dec. 1977), NUREG/CR-4829 (Shipping Container Response to Severe Highway and Railway Accident Conditions, Feb. 1987), and NUREG/CR-6672 (Reexamination of Spent Fuel Shipment Risk Estimates, Mar. 2000). WIEB is correct in that each of these studies used somewhat different assumptions on casks, routes, accident environments, and exposed populations.	None
WIEB	53	*NUREG-2125 is issued at a point when the U.S. Nuclear Waste Program is in reformulation, but at least a decade before procurement of casks in numbers required to support a large-scale spent fuel transport campaign. The January 2012 report of the Blue Ribbon Commission on America's Nuclear Future, recommended consideration of a standardized cask design with multiple purpose canisters. We assume that NRC intends to update this analysis when the casks for a large-scale campaign have been selected, but before large-scale procurement. And, we assume this update will be conducted with full input from stakeholders.*	The casks used in any future transportation campaign will need to meet the certification criteria of the NRC. Therefore, the performance of these casks is expected to be similar to those of Draft NUREG-2125. The responsibility for completing a risk assessment for any future transportation campaign will belong to the entity performing that transportation. When that analysis is performed, a decision on whether or not the casks used in NUREG-2125 adequately represent the casks that will be used in the transportation campaign will have to be made.	None
WIEB	54	**Technical and Perceived Risks.** *The SFTRA (pg. F-11) concludes that "the collective dose risks from routine transportation are vanishingly small," and that "if there were an accident during a spent fuel shipment, there is only about a one in a billion chance the accident would result in a release of radioactive material"— rather dramatic language for an NRC assessment of a contested topic.*	We are changing "vanishingly" to "very" to be less dramatic. The results of this study support the "one in a billion" statement.	Changed "vanishingly" to "very" in all instances.
WIEB	55	*Even if the assessment supports the dramatic summary language (which later comments question) these are findings of a NRC technical risk assessment — conducted by people with primarily technical backgrounds, working in an agency that is part of the U.S. nuclear complex and that is inclined to rely on technical bases for decisions, but which would not be directly involved in SNF transport planning and operation. By contrast, persons in communities affected by SNF transport will generally not have technical backgrounds, will have no association with the U.S. nuclear complex, and can expect no economic benefit from SNF transport through their communities. Their judgments will be based on perceived, not technical, risks—less on risk probability than extreme cases, less on technical risk than on institutional trust.*	We agree with the commenter that many members of the public are more concerned with extreme accidents. Therefore, the study also evaluated extreme cases and reported Maximally Exposed Individual (MEI) dose and collective dose for the most severe accident studied.	None

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WIEB	56	*People in corridor communities may be persuaded to accept technical risk assessments such as those in NUREG-2125, but they will do so based mainly on their judgment of the institutions and people responsible for the campaign (their competency, transparency and integrity), not on the basis of a technical risk assessment of SNF transportation casks. The NRC SFTRA should clearly convey that the NRC appreciates the distinction between technical and perceived risks in SNF transport. While we depend on NRC to provide assurance that the technical risks (as they relate to casks) are as low as reasonably possible, that assurance is only a first step in the design of a successful large-scale transport campaign. NRC should convey, not only that this is the case, but that it does not expect that it should be otherwise, and that it is reasonable and appropriate that affected people should consider factors other than technical risk. The National Academies recognized this as part of their 2006 study, "Going the Distance", as did the Blue Ribbon Commission in January 2012. The NRC should take care to avoid the implication that technical risk should be determinative.*	It is the responsibility of the NRC to explain why it believes its regulations provide adequate protection of health and safety, and this study is one of the bases for that explanation. Draft NUREG 2125 does not discuss or address perceived risk; it is a technical discussion of risks that are calculated from existing data and models. We have attempted to make the technical issues discussed in the document understandable to the public by including an 11-page public summary that attempts to convey the report content to a broad audience.	None
WIEB	57	*In addition, given the recent experiences with the Deepwater Horizon oil spill and the nuclear disaster at Fukushima, the public is understandably skeptical of government assurances that severe accidents cannot happen – when there is ample evidence to the contrary. The NRC must recognize that the public will likely not accept their technical findings.*	NRC does not deny that severe transportation accidents can, and do, happen, and assumes that these accidents will occur. That is the reason this study was performed. The study evaluated "beyond design basis" accidents in order to reach its conclusions. In addition to this risk study, the NRC has also evaluated recent severe transportation accidents and determined the response of spent fuel casks that were postulated to be involved.	None

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WIEB	58	**Sabotage-Terrorism Risk.** *Page 2 states that the SFTRA "does not include the probabilities or consequences of malevolent acts," and our inquiries on the topic are referred to NRC's Office of Nuclear Security and Incident Response. The 2006 National Academies' study, "Going the Distance" (pgs. 8-9) recommended an examination of the topic by a technically knowledgeable group that is independent of the government and free from institutional and financial conflicts of interest. The NAS recommends that this group should consider: a) the threat environment; b) the response of packages to credible malevolent acts; and c) operational security requirements. We and other State Regional Groups have recommended that the findings from such an examination should be shared with a selection of state government officials with appropriate technical background and clearances. We have also inquired whether the PRESTO and P-Thermal tools used in the SFTRA could be applied to assess the second of the three topics identified by the National Academies—the response of packages to credible malevolent acts.* *The purpose of this comment is not to suggest that security risk should be included in the SFTRA, but to make the obvious point that security cannot be divorced from other transportation risks in consultations with corridor communities, and to inquire about the status of the recommendations made by NAS in 2006, and subsequently by us and others. Were federal and state officials to consult with corridor communities regarding a SNF transport campaign, what would we be able to say about the risk of malevolent acts?*	We understand the states' concern about deliberate attacks on spent fuel shipments. However, as stated on page 2, this topic is outside the scope of this document.	None
WIEB	59	**Cask Design vs. Construction-Maintenance.** *A difference between the SFTRA and previous NRC transportation risk assessments is that the SFTRA descriptions for the selected casks include all the design margins (vis-à-vis NRC requirements) reflected in the manufacturer's certificate of compliance (pg. 9), and that these margins are not degraded in use over a 50-year transportation campaign. NRC's assurance that the design margins assumed are present in practice is based on: a) the NRC Quality Assurance Plan; b) NRC inspections (but not of every cask at each stage of manufacture); and c) an external radiation measure prior to each shipment.* *We would appreciate NRC consideration of how this quality assurance plan would function in a large-scale shipment campaign involving manufacture of many casks, each used many times in cross-country transport and handling.*	All of the cask vendors hold quality assurance (QA) programs that have been reviewed and approved by the NRC. All design and fabrication activities performed by the cask vendors is conducted under the aegis of their NRC-approved QA program. NRC performs routine inspections of both the vendors and the facilities where fabrication is conducted to ensure that such activities were conducted in accordance with NRsC QA regulations and that the fabricated casks match the design approved by the NRC in the cask CoC and Safety Analysis Report (SAR). Cask vendors must also comply with 10 CFR 71.85, "Preliminary determination," whereby they must ascertain that there are no cracks, pinholes, uncontrolled voids, or other defects that could significantly reduce the effectiveness of the packaging.	None

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			With regard to transportation of casks with spent fuel, all NRC licensees who ship licensed material in NRC certified packagings must comply with 10 CFR 71.17, which include provisions to have an NRC-approved QA program and to comply with provisions of the package CoC. Regardless of whether the transportation campaign lasts one year or twenty, all transportation activities during that time would be subject to requirements under Part 71 including: 1. Conduct of all transportation activities under the NRC-approved QA program. 2. Performance of 10 CFR 71.87, "Routine determinations," each and every time the package is shipped. 71.87 would serve as a mechanism to identify any degradation in the package components. 3. Adherence to the CoC conditions would require that the packages are maintained in accordance with maintenance requirements contained in Chapter 8 of the package SAR; such maintenance activities could include periodic inspection/replacement of gaskets, fasteners (bolts), or helium leak tests, dependent on the package design. All such maintenance activities are conducted under the licensee's NRC-approved QA program and the maintenance requirements must be current at time of transport and during the time that the package will be in transport.	
WIEB	60	*How does the NRC Quality Assurance Plan ensure that the design margins assumed in the SFTRA are retained over a large-scale, long-term transportation campaign?*	See above	None
WIEB	61	*Which of the design margins included in the certificate of compliance are most likely to be degraded in use, and how would NRC processes identify and address these early rather than late?*	With the QA program identified above, none of the design margins would be degraded over use. Licensees are required, under 10 CFR 21, to report any deficiencies that would degrade the performance of the package.	None

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WIEB	62	**Finite Element Models.** *We appreciate the necessary role of finite element models (such as PRESTO and P-Thermal) in assessing the response of specific cask designs to specified events. We would appreciate a better understanding of how these models are calibrated or benchmarked to represent different cask designs, and how they reliably predict the interactions of the several cask components (impact limiter, cask body and wall, cask and canister seals, SNF contents) in extreme events or event sequences:*	The report provides an example of a comparison between finite element analysis and test results for a large fire test in Appendix D. Similar comparisons have been made for regulatory and extra-regulatory impact analyses. There have been many physical tests on casks and cask components that have been compared to finite element predictions of the tests. Many spent fuel casks are certified by a combination of testing and analysis, where the testing is used to validate the finite element analysis.	Added this to the report in Section 3.2: The results from analyses using this type of code have been compared to results from both regulatory and high-speed impact tests. A recent Safety Analysis Report Addendum for the PAT-1 air transport package compared the very large deformations seen in full-scale testing of this package to those calculated using nonlinear explicit dynamics (Yoshimura et al., 2010). There have also been comparisons between full-scale regulatory drop tests of two spent fuel casks in Germany with explicit dynamic finite element analyses (Junichi Kishimoto et al., 2007, Musolff et al., 2007).
WIEB	63	*What physical tests of casks and cask components have been conducted? How are these results (which reflect a specific event) incorporated into finite element models and applied to predict cask response in very different events?*	See response to comment 62.	None
WIEB	64	*What physical tests of cask scale models have been conducted, and how can we be confident that these results apply to full-scale casks of other designs under different event scenarios?*	All three of the casks used in this study included scale model drop tests as part of their determination of compliance with applicable regulatory requirements during the certification process.	None
WIEB	65	*Has NRC identified other physical tests needed to improve the calibration of its finite element models and their representation of extreme events or event sequences?*	NRC has not identified the need for additional physical tests to improve the calibration of finite element models. NRC is confident in the ability of finite element models to assess the behavior of casks in extreme events. Please refer to the references in the response to comment 62.	None
WIEB	66	*We appreciate that this may not be easily explained to the uninitiated, but it is a necessary step to develop confidence in the results produced by complex models. Implicitly, the SFTRA asks stakeholders to not only accept but to rely on the results of finite element models. Appendix C ("Details of Cask Response to Impact Accidents") discusses how the models were applied in the SFTRA analysis, but is less clear about how the models reflect physical tests of cask components, scale models and/or full-scale tests, and how these reflect the Section 71.73 cask sequence:*	Draft NUREG-2125 used only casks designs that are NRC-certified, and therefore have already been demonstrated as having satisfied the regulatory hypothetical accident conditions in 10 CFR Part 71. Through the certification process, NRC is confident in the ability of casks to satisfy the sequential accident requirements of 10 CFR Part 71.73. All of these casks were demonstrated to meet the requirements by a combination of testing and analysis. Draft NUREG-2125 evaluated how these casks would perform in beyond-regulatory-accident-conditions. The models and analytical techniques used are appropriate for these types of evaluations.	None

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WIEB	67	*Sections C.4.3-4.5 reference tests used to derive the forces imparted by impacts on various targets, but these were generally conducted in the 1970s or 1980s.*	This is a correct observation. If the tests had been conducted more recently, it is likely we would have more information to compare the model results to the test results. It was beyond the scope of this study to conduct additional tests. However, the data that was generated by these earlier tests used reliable methods such that the NRC is comfortable employing these data in the current study.	None
WIEB	68	*Section C.5.1 (pg. C-62) states the following: "The response of spent power reactor fuel assemblies to impact accidents is not well understood. While this area has been investigated in the past (Sanders et. al., 1992), those models tended to be relatively crude and imprecise. In addition, utility companies have renewed their interest in shipping higher burnup spent fuel. Therefore, it is essential to determine a more accurate response of spent fuel assembly to impact loads that may be affected by transportation or handling accidents or malevolent acts."*	In the extra-regulatory accident conditions considered in this assessment, we assume 100% fuel failure in any accident that results in release of radioactive material and the failed fuel results in the radioactive material that is available for release.	None
WIEB	69	*The SFTRA needs a side-by-side assessments of cask components, physical tests (reflecting the Section 71.73 sequence and other accident conditions), model calibrations, and NRC's assessment of the gaps in model representation of potential accident conditions.*	In the certification review of a cask design, the NRC requires this level of detail to validate the models used. The history of these certification reviews has made the NRC confident in the ability of finite element models to accurately predict cask response.	None
WIEB	70	**Sample Routes.** *We understand that the routes in the SFTRA (pgs. 23-27) are intended as examples. However, shipment to Hanford is illegal under the state-federal agreement, and Skull Valley is a SNF storage destination that does not have host state consent. Three of the four origin sites for removal to consolidated storage are east of the 100th meridian, while three of the four destination sites are west of the 100th meridian. The implications of these storage destinations for disposal site identification are not considered.* *We suggest that NRC consider ways to conduct the analysis while avoiding implications regarding the siting of off-site storage or disposal facilities.*	We acknowledge the comment. However, transportation risk assessments require designation of shipment points of origination and destinations. Currently, there are no planned spent fuel shipping campaigns. Draft NUREG-2125's shipment points of origination and destination were selected to illustrate long-haul geographic diversity. We believe the disclaimer makes this clear. While other origination/destination pairs are possible, the Draft NUREG-2125 pairs are adequate for the stated purposes of the study. Also, the report makes clear that Draft NUREG-2125 is a generic spent fuel transportation risk assessment, and is not intended as a facility- or site-specific environmental assessment.	Repeated existing Draft NUREG-2125 disclaimer that routes shown are for illustrative purposes only, and that no SNF shipments are planned from any of Draft NUREG-2125's points of origination to any of Draft NUREG-2125's destinations. (at least once in chapter 2, chapter 5, appendices B, E, and F)
WIEB	71	**Route Assessment.** *The route assessment tools used in the SFTRA analysis have limitations that reflect limited maintenance-development funding in recent years:*	Noted, but beyond the scope of this study to fix.	None

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WIEB	72	*Even with an adjustment from 2000 to 2006, resident population estimates are six years out-of-date.*	We had hoped that WebTRAGIS would be able to update the exposed populations using 2010 census data, but that was not possible prior to the completion of this NUREG. Instead, the same procedure that was used to adjust the 2000 census data to 2006 was used to calculate the change between 2006 and 2010. A new table was added to the report showing this change.	Added a table (B-6) of state population increases from 2006 to 2010 and inserted this text in section B.4: It was anticipated that 2010 census data would be available for this final report, but at the time of this writing it still was not possible to obtain updated population data in WebTRAGIS. An estimation of the error introduced by not updating to the 2010 census can be made by using the same method that was used to adjust the populations to 2006 data. The correction factors for each state are given in Table B-6.
WIEB	73	*The TRAGIS process for identifying rural, suburban and urban route segments (Fig. 2.4) is rather crude and not confidence inspiring.*	TRAGIS (Transportation Routing Analysis Geographic Information System) software, developed by Oak Ridge National Laboratory (ORNL), determines routes from specified starting and ending points for highway, rail, or waterway transportation within the continental United States. Various criteria for the route(s) to be determined may be specified including Highway Route Controlled Quantity (HRCQ) criteria, which are used for the 16 routes presented within this document. TRAGIS also uses data from the ORNL database Landscan USA to determine populations along the route and bin these populations into rural, suburban, and urban subsets for each state within the route. For population determinations, the user may specify the buffer zone from which the population is calculated. The default buffer zone is 800 meters (on either side of the route) and this default buffer is used in this document. TRAGIS can be used to create the route-specific population input data for the Sandia National Laboratory developed software RADTRAN as was done for this study.	The description of how WebTRAGIS computes populations and bins them has been added to Section 2.3.2.
WIEB	74	*Estimates of non-residential populations (employment, shopping, education and entertainment centers) use a RADTRAN "back-of-the-envelope" method.*	The estimate of non-resident population, more properly called "sidewalk occupants," is based on a New York City model and is conservative. However, the multiplier used for the non-resident population applies only to a population occupying a 3-meter-wide sidewalk along a secondary road in an urban area. The multiplier does not apply to railroads or limited-access highways which have no adjacent sidewalks.	Added a more detailed explanation of the sidewalk occupants in the footnote to Table 2-3. Change non-resident/resident ratio to sidewalk occupants to residents ratio.

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WIEB	75	*The problem with these calibration issues is not necessarily that they dramatically affect assessment results, but that they affect the credibility of the process by not reflecting what stakeholders know to be the case in their own communities. WIEB and others have suggested remedies, which should be considered and incorporated before these tools are applied in actual transportation system design.*	Agree. On a community by community basis, RADTRAN as it exists can incorporate data for that community that takes into account where any number of people are at any given time of day. To incorporate this precision would require a clearinghouse of this type of information nationwide, which does not presently exist. Refer to BRC recommendation on planning actual transportation system 10 years prior to commencement of shipments.	None
WIEB	76	**Radiation Risk.** *As we understand, the GA-4 cask selected for the SFTRA (pg. 10) would be shipped under heavy-haul rules, which involve logistical complications and potential delay. Are these complications and delays reflected in the RADTRAN assessment of radiation exposure? The NAC-STC and Hi-Star 100 rail casks selected for the SFTRA would be used to remove fuel from site that lack Class A rail access, and thus require intermodal shipment and transfer before cross-country shipment. Are these logistical complications reflected in the RADTRAN assessment of radiation exposure?*	The GA-4 was designed as a legal weight truck cask. It may or may not be shipped under heavy haul rules in future shipping campaigns. Draft NUREG-2125 did not model the heavy haul scenario so as to maintain comparability with previous spent fuel shipment risk assessments. It is expected that the logistics of any future major transportation campaign will be addressed by the entity performing the transportation. Draft NUREG-2125 does assume an inspection stop at each state border, and it is believed this stop time is most likely longer than the time required to complete the necessary overweight truck permitting activities. Also, Draft NUREG-2125 does not consider intermodal transport of the rail casks (either as heavy-haul truck or barge). If this action were needed within a transportation campaign, it would be the responsibility of the planners to incorporate these activities.	None
WIEB	77	**Fire Risk Assessment.** We have several, related questions regarding the SFTRA fire risk assessment: Actual and Modeled Fire Plumes. The introduction (pg. 71) states that, since "(a)ctual fire plumes have location- and time-varying temperature distributions that vary from about 600 degrees C to more than 1200 degrees C … an evenly-applied 800 degrees C … used in a certification analysis could be more severe for cask seals and fuel rod exposure than exposure to an actual fire." *Please explain why 800 degrees C evenly-applied would be "more severe" than a location and time-varying temperature of 1200 degrees C. Would this not depend on how much the location and time varies in the actual fire?*	The analyses for this report demonstrate that casks that are designed using the regulatory fire analysis technique provide containment of their contents in all realistically probable fire accidents. Comparison of Figures 4-8 and 4-10 for the Rail-Steel cask and Figures 4-23 and 4-25 for the Rail-Lead cask show the uniform heating results in nearly identical peak fuel temperatures as the CAFE analyses, with their location and time varying fire temperatures.	Changed the quoted text from Section 4.1 to "an evenly-applied 800 degrees C … used in certification analyses applies a similar heating as an actual fire."

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WIEB	78	*Would an evenly-applied 800 degrees C be more likely to cause fuel rod burst than a actual fire which reaches 1200 degrees C for 5-10 minutes?*	Comparison of Figures 4-8 and 4-10 for the Rail-Steel cask and Figures 4-23 and 4-25 for the Rail-Lead cask show the uniform heating results in nearly identical peak fuel temperatures as the location and time varying CAFE fire. The duration of the 1200°C temperatures at a fixed location would be much less than 5-10 consecutive minutes. These very high temperatures can only be observed in hydrocarbon pool fires for very short times at locations within the fire where such flame temperatures are even possible, which is not all locations on the cask surface. There is no fuel rod burst in any fire accident scenario evaluated in Draft NUREG-2125.	None
WIEB	79a	**Fire Scenarios Assessed.** As we read their descriptions in Section 4.2 (pgs. 72-75), the SFTRA fire scenarios involve none in which: a) an accident precedes the fire. *If this observation is correct, we suggest that the SFTRA discuss the circumstances that its analysis does not address and why.*	The probability of an extra-regulatory fire following an extra-regulatory impact (which could cause the impact limiters to be damaged more than localized crushing) is extremely small and therefore this accident has no contribution to the risk result.	Added to Section 4.3.2: Prior analyses of casks comparing the thermal results for regulatory fires with impact limiters damaged from the regulatory impact test vs. undamaged limiters has shown very little effect from including the damage (Lopez and Ammerman, 2004). Damage to impact limiters from an extra-regulatory impact is not considered because of the extremely low probability that an extra-regulatory impact will be followed by a long duration fire.
WIEB	79b	*and/or b) the fire occurs in an enclosed space (e.g. the MacArthur Maze, the Baltimore Tunnel),*	The NRC's analyses of these events show either no or only a small release of radioactive material, less than that calculated for the most severe impact analyses of this report. Because this accident type is so improbable, including it would not change the results of this report. For example, the probability of the MacArthur Maze fire as analyzed in Bajwa et al. 2012 is less than $3x10^{-11}$, and would need to result in a release of more than 140 A_2 to change the results of this report.	Added a more detailed discussion of the NRC analyses of MacArthur Maze and Baltimore Tunnel, see response to comment 42.
WIEB	79c	*and/or, c) the fuel cladding is deteriorated or damaged*	Because there is no seal failure, the condition of the fuel will not change the response to the fire accidents.	Added to Section 4.3.3: The condition of the fuel is not important for this analysis, but the fuel response model in Appendix C suggests that following a regulatory impact accident there would be no failure of the fuel cladding or collapse of the fuel spacer grids.

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WIEB	80	The 10 CFR 71.73 "Sequential Application." The chapter summary (pg. 107) states that "This chapter presents the realistic analyses of four fire accident scenarios … described in 10 CFR 71.73." However, Section 71.73 states that "(e)valuation for hypothetical conditions is to be based on sequential application of the tests specified … in the order indicated,2 to determine their cumulative effect on a package … ." (emphasis added). *If the SFTRA does not analyze the test sequence, can it say that "it presents the realistic analyses of … the hypothetical accident conditions described in 10 CFR 71.73"?*	The response of casks to the regulatory hypothetical accident sequence is well known. This report is primarily interested in accidents that are more severe. The probability of an extra-regulatory fire following an extra-regulatory impact (which could cause the impact limiters to be damaged more than localized crushing) is extremely small and therefore this accident has no contribution to the risk result. The first bullet intends only the regulatory fire of 10 CFR 71.73 (c) (4), not the entire accident sequence.	In the first bullet of section 4.5, the regulatory citation has been changed to 10 CFR 71.73 (c) (4).
WIEB	81	**Public Involvement and Participation**. *We understand that the SFTRA has been under development for several years. Yet, we did not learn of it until two months ago—May 16, when the 500-page draft report was introduced but not discussed in detail at the National Transportation Stakeholders Forum. We would appreciate a greater opportunity for review and input as the SFTRA is revised and finalized. In this process, we would appreciate NRC's consideration and responses to the questions and issues raised above.*	We appreciate WIEB's comments. Our responses to public comments and associated revisions to Draft NUREG-2125 are as described in this table.	None
OR/DE	82	*Thank you for the opportunity to offer comments on the U.S. Nuclear Regulatory Commission's draft Spent Fuel Transportation Risk Assessment (NUREG-2125).* *The State of Oregon supports the comments submitted on this report by the Western Interstate Energy Board's High-Level Radioactive Waste Committee on July 13, 2012.*	We appreciate Oregon's comments. The responses to comments from WIEB are given above.	None
OR/DE	83	*We strongly recommend that when finalizing this report, that the NRC does not include the Hanford Site as a representative destination for spent fuel shipments. Issues related to the import of waste to Hanford are highly contentious and divisive and can and have interfered with the environmental cleanup that is now in its 24th year. While we recognize Hanford was selected as a representative site to allow for analysis of long-distance routes, identifying it in a manner such as this perpetuates the belief that Hanford should be considered for further waste disposal and storage missions. Hanford is not a suitable location for receipt of spent nuclear fuel from commercial reactors or other waste streams. NRC staff certainly recognized the political sensitivity of not selecting Yucca Mountain as a representative destination. The same considerations should have been made with regards to Hanford.*	The Hanford site was included (a) because it is the terminus of a very long route and (b) because it was one of the sites in NUREG/CR 6672. However, transportation risk assessments require designation of shipment points of origin and destination. Currently, there are no planned spent fuel shipping campaigns. Draft NUREG-2125's shipment points of origination and destination were selected to illustrate long-haul geographic diversity. We believe the disclaimer makes this clear. While other origination/destination pairs are possible, the Draft NUREG-2125 pairs are adequate for the stated purposes of the study. Also, the report makes clear that Draft NUREG-2125 is a generic spent fuel transportation risk assessment, and is not intended as a facility- or site-specific environmental assessment.	Repeated existing Draft NUREG-2125 disclaimer that routes shown are for illustrative purposes only, and that no SNF shipments are planned from any of Draft NUREG-2125's points of origin to any of Draft NUREG-2125's destinations. (at least once in chapter 2, chapter 5, appendices B, E, and F)

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OR/DE	84	*While we agree that spent nuclear fuel can be transported safely, we believe many other factors beyond the robustness of the cask must be considered in developing a national transportation safety program for spent nuclear fuel in order to reduce the likelihood of an accident and better address public concerns. The transportation program adopted for shipments of transuranic waste to the Waste Isolation Pilot Plant (WIPP) provides a useful template in developing a spent fuel transportation program. The WIPP transportation program includes, among other things, requirements to ensure highly qualified drivers; rigorous maintenance and inspection of the transport vehicles; provisions to ensure that vehicles are not traveling in hazardous weather conditions; satellite tracking of the vehicle; and a robust emergency preparedness training and exercise program to ensure emergency responders along the transport corridors are prepared when an accident does occur.*	We appreciate Oregon's agreement that spent nuclear fuel can be transported safely. Draft NUREG-2125 is not a plan for a transportation campaign but an analysis of the risks of transportation; Draft NUREG-2125 does not suggest any risk mitigation. The other precautions taken, like driver training, would be included in future environmental assessments, as was done in the WIPP recertification documents. Draft NUREG-2125 did not take any credit for the reduced accident rate that is likely to be achieved as the result of these measures.	None
OR/DE	85	At the National Transportation Stakeholder's Forum in Knoxville, Tennessee in May, NRC staff indicated that the public and the news media are primary audiences for this document. To that end, we commend the NRC for including Appendix F – "Public Summary," which is generally well written and easy to understand. *However, to make the document even more understandable, scientific notation should not be used.*	Scientific notation in Appendix F will be replaced with decimal equivalents.	Replaced scientific notation in the public summary with decimal equivalents.
OR/DE	86	*The graphics shown on Pages F-8 and F-9 are also not useful in black and white.*	This is the reason the document is published in color. As a cost saving measure, NRC only prints draft NUREG documents in black and white, but the final NUREG will be printed in color and the electronic version of the draft, available on ADAMS, is also in color.	None
OR/DE	87	*There is no explanation of why this study was done at this time. Just because the tools are available to conduct a more detailed study does not explain why a decision was made to take a new look at potential spent fuel transportation risks – especially given that they were already calculated to be very low. A compelling explanation of why the new study was conducted at this time should be added.*	The study was initiated in 2006 to evaluate the relatively new concept of transporting fuel within inner welded canisters. As stated in the introduction, it also follows the ~12 year interval for NRC generic transportation risk studies.	None
OR/DE	88	*The document – especially the Executive Summary and Appendix F – should better reflect risk communication techniques. There are numerous examples within both sections where unlike risks are compared with one another (for example, transport risk versus natural background, and transport risk versus cancer therapy treatment).*	In the routine transport, the comparison is between the dose from natural background and the dose from transport. We agree the comparison between accident MEI dose and cancer therapy was inadvertent, and will be replaced with: "If there were a release of radioactive material in a spent fuel shipment accident, the dose to the MEI would be less than 2 Sv (200 rem), and would be nonfatal."	Reference to cancer therapy has been removed.

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OR/DE	89	*The text on page F-9 refers to an "improbable accident," and the text on page F-11 states that "if there were an accident during a spent fuel shipment, there is only about a one in a billion chance the accident would result in a release of radioactive materials." Given recent experiences with Deepwater Horizon and Fukushima, the public has rightly become skeptical about government proclamations of the unlikelihood of a severe accident. The public has clearly seen that severe accidents are very much possible.*	NRC does not deny that severe transportation accidents can, and do, happen, and assumes that these accidents will occur. That is the reason that risk assessments are performed. The study evaluated "beyond design basis" accidents in order to reach its conclusions. In addition to this risk study, the NRC has also evaluated recent severe transportation accidents and determined the response of spent fuel casks that were postulated to be involved.	None
NEI	90	*The Nuclear Energy Institute (NEI)1, on behalf of the nuclear energy industry, is pleased to submit comments on the draft NUREG-2125 "Spent Fuel Transportation Risk Assessment", as requested by the U.S. Nuclear Regulatory Commission (NRC) in the Federal Register on May 14, 2012 (77 Fed. Reg. 28406). We appreciate this opportunity to provide comments, and believe that by providing opportunities for stakeholder input, the NRC is helping to assure a sound and predictable regulatory framework.*	We appreciate your comment.	None
NEI	91	*The risk assessment is based upon appropriate inputs and assumptions, and applies rigorous analyses and evaluations, which results in a well-founded and reliable basis for the conclusion that transportation risks are low, in fact significantly below previous, already low, estimates. This assessment improves upon previous studies, because it analyzes actual certified casks, applies more accurate modeling techniques, and uses more recent accident frequency and population data. Yet, it is still conservative. The results demonstrate that transportation under normal and potential accident conditions is safe, and that the current regulations of 10 CFR Part 71 provide reasonable assurance of public health and safety.*	Staff agrees with the comment.	None
NEI	92	This latest risk assessment for transportation of used fuel is timely as its publication coincides with the recent NRC Risk Management Task Force report, NUREG-2150 "A Proposed Risk Management Framework". In that report, the Task Force made several recommendations for implementing a risk management regulatory framework for transportation of radioactive materials, including "…focus its risk management efforts, in the near term, on improving the guidance used in implementation of the current transportation regulations." *This recent risk assessment should be included in the NRC's efforts to implement the Task Force's recommendations to further risk inform 10 CFR Part 71.*	NUREG-2125 will be available for consideration in NRC's risk management activities.	None

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NEI	93	*On page 29, the 1st bullet states that "Suburban residents sustain the largest dose for all routes and shipment modes." We recommend adding a sentence to explain the basis for this conclusion, since it is not obvious from the data in the associated tables. We note that the explanation may be related to footnote (a) to Table 5-4 on page 114, which describes that urban dose is less than suburban dose due to shielding.*	The reason for the higher suburban dose is the shielding factor for suburban residents is much lower than the shielding factor for urban residents. The increase in urban population density is offset by the shorter urban distance, and the exposed population in urban and suburban areas is generally about equal.	Added text from footnote a into section on page 29.
NEI	94	*On page 73, item #2 appears to be part of item #1. Please check if there is a typo and whether #1 and #2 should be combined under #1. Combining these would be more consistent with the three scenarios described in the opening paragraph of Section 4.2.3.*	This is an error. There should only be three items.	Item 2 was included as part of item 1 and items 3 and 4 were renumbered.