NUCLEAR ENERGY INSTITUTE

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Chief, Rules, Announcements, and Directives Branch (RADB)
Office of Administration
Mail Stop: TWB-05-B01M
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Subject: Industry Comments on draft ISG-8 Revision 3 "Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transport and Storage Casks" (Docket ID: NRC-2012-0100)

Project Code: 689

Dear Ms. Bladey:

The Nuclear Energy Institute (NEI),[1] on behalf of the nuclear energy industry, is pleased to submit comments on the draft Interim Staff Guidance (ISG) 8, Revision 3 "Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transportation and Storage Casks," as requested by the U.S. Nuclear Regulatory Commission (NRC) in the *Federal Register* on May 2, 2012 (77 *Fed. Reg.* 26050). 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.

The industry's comments on the NRC's draft ISG-8 Revision 3 are included in the attachment to this letter. In general, we believe that the latest revision is an improvement in the guidance. However, a few areas of the guidance could benefit from application of additional risk insights and by more directly recognizing alternative approaches. In line with this general comment, most of our specific

[1] NEI is the organization responsible for establishing unified nuclear industry policy on matters affecting the nuclear energy industry, including the regulatory aspects of generic operational and technical issues. NEI's members include all entities licensed to operate commercial nuclear power plants in the United States, nuclear plant designers, major architect/engineering firms, fuel fabrication facilities, nuclear material licensees, and other organizations and individuals involved in the nuclear energy industry.

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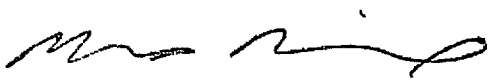
comments are intended to make the guidance more risk-informed and flexible to facilitate the proposal of alternatives by applicants.

While not specifically identified in the NRC's *Federal Register* Notice, we note that the revision to ISG-8 is also a follow-up activity to the Commission's direction to further apply burn-up credit for dry cask transportation, as described in SRM-SECY-07-0185 "Moderator Exclusion in Transportation Packages." In this regard, we would like to begin a dialogue with the NRC on whether the burn-up credit described in ISG-8 Revision 3 is sufficient to satisfy the Commission's recommendation and whether the staff might also consider re-initiating a moderator exclusion rulemaking.

We appreciate the NRC's interest in stakeholder input to draft ISG-8 Revision 3; however, we note that the NRC provided only 30 days for stakeholders to provide this input. Given the complexity and extent of detail incorporated into Revision 3, and the extent of our comments, we believe further interaction with stakeholders is necessary prior to the NRC finalizing the guidance. We would appreciate an opportunity for further discussion at a public meeting. If you have any questions, please contact me.

Sincerely,



Marcus Nichol

Attachment

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NEI Dry Storage Task Force
NEI Criticality Task Force

Attachment
Industry Comments on draft ISG-8 Revision 3 "Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transport and Storage Casks"
(DOCKET ID NRC-2012-0100)

Major Comments

We commend the NRC on improving the guidance on burn-up credit in the latest draft Revision 3 of ISG-8 "Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transport and Storage Casks." We recognize the NRC's efforts to better risk inform its guidance, for example in allowing a smaller administrative margin for misload analyses, but also believe that additional risk information can and should be incorporated in this latest revision, for example in the area of burn-up verification. We note that risk informing cask transportation and storage regulations (10 CFR Part 71 and 10 CFR Part 72), was recently recommended by the Task Force headed by Commissioner Apostolakis in NUREG-2150 "A Proposed Risk Management Regulatory Framework", and is the subject of the NRC's "Risk-Informed Decisionmaking for Nuclear Material and Waste Applications" framework. We urge the staff to apply these recommendations in this revision to ISG-8.

We believe that guidance should be flexible, performance based, and avoid being prescriptive as much as possible. Flexible guidance that facilitates the proposal of alternative approaches is essential to an efficient regulatory framework, as it allows for the adoption of new technologies without the need to continuously update guidance. We commend the NRC's efforts to broadly define a set of recommendations for an approach to burn-up credit that also permit alternatives; however, we believe this could be expanded. One area that would benefit from greater flexibility is the guidance for code validation for burn-up credit, which currently goes into great detail describing the approach that was developed by ORNL, but does not adequately facilitate the proposal of alternatives. One such alternative has already been developed by EPRI in "Benchmarks for Quantifying Fuel Reactivity Depletion Uncertainty – 1022909", and EPRI is planning to submit a request for fee waiver to the NRC for a Topical Report review.

It is noted that while the intent of the Interim Staff Guidance is to provide guidance to staff reviewers, much of the guidance in ISG-8 communicates one or more acceptable approaches to applicants, licensees and CoC holders. A clearer distinction between these purposes in ISG-8 would improve its ease of use. In fact, those areas of the guidance communicating acceptable approaches to applicants and licensees are better suited to a Regulatory Guide. Therefore, we recommend the NRC issue a Regulatory Guide with the guidance intended for industry, when the guidance for staff is incorporated into the Standard Review Plans.

The following major comments are intended to identify where the guidance would benefit from further applying risk insights and by more directly recognizing alternative approaches. We would appreciate an opportunity to have a more detailed discussion on these areas of the guidance in a public meeting prior to the NRC issuing the final guidance.

1. More risk-informed approach to burn-up verification

A more risk informed approach to the burn-up verification (Section 5 "Loading Curve and Burnup Verification", starting on page 6) would ensure safety and regulatory compliance, while also ensuring efficient use of industry and NRC resources. To achieve these goals, we recommend a

fundamentally different approach to guidance on burn-up verification that consists of a preferred approach based primarily upon the use administrative procedures, with the misload analysis providing defense-in-depth, and eliminates burnup measurements. This approach is consistent with current industry practice in accordance with NRC approved cask licensing bases, and is supported by the technical references cited in the draft guidance. We further note that this is the most effective method of addressing the situations that could result in a misload. Specifically, we believe the guidance should be revised as follows:

a) We recommend that the guidance further clarify that the purpose of burn-up verification is to prevent the only three credible situations that could result in more reactive assemblies being loaded (defined herein as a misload): 1) loading the wrong fuel assembly, 2) calculating a burn-up value higher than actual, and 3) assigning the wrong burn-up value to a fuel assembly. Expanding upon the key concept on page 6, which states that the purpose of burn-up verification is to "ensure that a storage or transportation system evaluated using burn-up credit is not loaded with an assembly more reactive than those included in the loading criteria" will provide a clear basis for the guidance related to appropriate methods of burn-up verification, and ensure efficient use of industry and NRC resources in the licensing, implementation, and oversight of these activities.

b) We recommend that the set of administrative procedures included in the guidance be designed to focus on the three credible situations that could result in a misload. In this regard, we believe that the following seven administrative procedures are the most appropriate set, since they are the most effective in achieving their objective and result in the least amount of burden on licensees. Using these as the main approach for burn-up verification will provide reasonable assurance that a more reactive assembly will not be loaded by 1) loading the wrong assembly (i.e. #1, #2) , 2) calculating a burn-up value higher than actual (i.e. #4), or 3) assigning the wrong burn-up value to a fuel assembly (i.e. #3, #5). Use of the licensee QA program (#6) ensures the effectiveness of administrative procedures #1-5, and verifying the soluble boron (#7) ensures compliance with the licensing basis. We request that the administrative procedures in draft revision 3 of ISG-8 be replaced by the following:

   #1. Verify the identity of the fuel assembly prior to loading it into the cask
   #2. Verify the identity of the fuel assemblies loaded into the cask prior to closing the cask
   #3. Verify the burn-up values of each fuel assembly to be loaded into the cask from a source QA record prior to loading the first assembly
   #4. Reduce the verified reactor record burn-up value by uncertainty in the record value, this is the burn-up value to be used for loading acceptance
   #5. Verify that each fuel assembly to be loaded into the cask satisfies the loading requirements prior to loading the first assembly
   #6. Develop and perform procedures/processes in accordance with the QA program
   #7. Verify that the soluble boron concentration in the pool and cask is greater than the minimum required prior to cask loading

c) We believe the following administrative procedures described in the draft guidance lack the efficiency and effectiveness that are achieved through our seven recommended

administrative procedures. We therefore recommend they be removed and replaced with the seven administrative procedures listed above:

- *Assurance that there is no fresh fuel in the pool during system loading*: This procedure would not contribute to preventing a misload of an assembly under any of the three situations identified. While it is acknowledged that this would mitigate the consequences of 1) loading the wrong fuel assembly, it is also recognized that such an occurrence would be more effectively prevented by our recommended administrative procedures. Therefore, imposing a condition that there is no fresh fuel in the pool during system loading would be unnecessary as it does not decrease the likelihood of a misload event. This condition would be more applicable to the consequences of a misload event and would be better addressed in the consideration of the assumptions for the misload analyses, as discussed in comment #1d. From a practical standpoint, we recognize that licensees typically do not load casks while fresh fuel is in the pool, however, there could be an instance when this is necessary.
- *Verification of the location of high reactivity fuel (i.e., severely underburned fuel) in the spent fuel pool both prior to and after loading:* This procedure would not contribute to preventing a misload of an assembly under any of the three situations identified. The intent of this procedure appears to be to prevent 1) loading the wrong fuel assembly; however, it is insufficient to accomplish this objective since it does not verify the actual assemblies to be placed into the casks. In fact, the recommend administrative procedure #1 above would be more effective at preventing 1) loading the wrong fuel assembly, since it verifies the assemblies to be loaded into the cask. Our recommended administrative procedures would also be more efficient since many spent fuel pools contain hundreds or thousands of fuel assemblies, and therefore it requires fewer resources to verify the assemblies that <u>will</u> be loaded into the casks rather than the assemblies that <u>will not</u> be loaded into the casks.
- *Qualitative verification that the assembly to be loaded is burned (visual or gross measurement):* This procedure would not contribute to preventing a misload of an assembly under any of the three situations identified. A qualitative verification may prevent a fresh fuel assembly from being selected, however this would duplicate the proposed action to ensure fresh fuel is not in the pool during loading, which as discussed above would not decrease the likelihood of a misload event. This condition would be more applicable to the consequences of a misload event and would be better addressed in the consideration of the assumptions for the misload analyses, as discussed in comment #1d. Furthermore, it is unclear how this would be performed. While "visual" implies that the guidance anticipates some physical change, such as color, may be readily verified, "gross measurement" appears to imply that a burn-up measurement is necessary.
- *Confirmation that an audit of the pool inventory has been performed no more than one year prior to the time of loading:* This procedure would not contribute to preventing a misload of an assembly under any of the three situations identified.

Reliance on a licensee's QA program to ensure configuration control of the pool inventory is sufficient to ensure that physical storage of fuel in the pool is consistent with the records, and the performance of a misload analysis provides defense-in-depth for a highly unlikely human error. Since the QA program and Part 50 administrative procedures are appropriate for other Part 50 activities, such as loading fuel into the reactor and storing fuel in the pool, they should also be appropriate for ensuring fuel is in the proper pool storage location prior to cask loading. Furthermore, verification of the identity of the fuel assembly prior to and after loading into the cask will be performed through our recommended administrative procedures #1 and #2, which is a more efficient method since auditing the pool inventory every year requires a tremendous amount of resources and may not be feasible for licensees. We also note that 10 CFR Part 74 contains requirements for material control and accounting (MC&A), for which licensees perform inventories of the pool. The condition in the draft guidance could become duplicative, or possibly impose additional conditions that were purposefully avoided in the requirements of 10 CFR Part 74 because they result in undue burdens. Finally, guidance should not create expectations for which there is not a requirement in Part 72 regulations (e.g. MC&A), when there are requirements established by other Parts of the regulations, e.g. Part 74.

- *Quantitative measurement of any fuel assemblies without visible identification numbers:* This procedure would not contribute to preventing a misload of an assembly under any of the three situations identified (see comment #1.e on the reason burn-up measurements do not accomplish the objective of preventing a misload). Our recommended administrative procedures necessitate that an assembly's identification number is visible prior to loading into a cask. As a practical matter, all fuel assembly will have visible identification numbers, and will be verified by our recommended seven administrative procedures (specifically #1, 2, and 6). If there is a case where the assembly identification number is not visible, then it would not be permitted to be loaded, unless other means were developed and have prior NRC approval. Since this situation is not anticipated and would be a highly unlikely case, we do not believe that guidance needs to accommodate loading fuel without a visible identification number.
- *Independent, third party verification of the loading process:* This procedure goes beyond the NRC requirements for QA programs, and is not warranted. It is noted that NRC routinely credits licensee QA programs for ensuring configuration control for activities such as reactor core loading and spent fuel pool storage loadings, and we do not believe that more a more rigorous NRC expectation for cask loading is warranted. Requiring a third individual to verify the correct loading will involve them in the loading campaign. Thus, it is not possible to verify the loading process by someone not involved in the loading campaign. As a practical matter, many licensees do include verification of the loading process by a third independent individual. We believe that it would not be appropriate for the guidance to impose conditions that exceed NRC QA requirements, and that decisions on whether or not to institute

practices that go beyond the NRC's QA requirements is best determined by individual licensees.

d) We recommend that the role of the misload analysis be redefined as defense-in-depth to the administrative procedures in a risk informed manner. The draft guidance's current approach is to use the misload analysis as an alternative to burn-up measurement, in order to prevent a misload from occurring. The guidance places the administrative procedures in a defense-in-depth role to the misload analyses. We believe the draft guidance has reversed the role of these; i.e. it is the administrative procedures that prevent a misload and the misload analyses are performed as defense-in-depth to ensure the consequences of a highly unlikely human error resulting in a misload would be acceptable. This approach would more effectively ensure subcriticality due to the following two considerations. First, this would decouple the intent of the misload analysis from what the guidance intends the burn-up measurement to accomplish (i.e. the objective to prevent a misload). This is appropriate since a misload analysis has no effect on the likelihood of a misload occurring, it only evaluates the consequence of a misload. Administrative procedures provide the function of preventing a misload, and therefore should be the primary consideration. Second, this would allow the misload analysis to be applied in a risk informed manner and as defense-in-depth to the administrative procedures. This is appropriate since the misload analysis would be used to analyze the consequences of a highly unlikely misload event, and to ensure that such an event would remain subcritical. Emphasis on administrative procedures as the means to prevent a misload, and thus ensure subcriticality, also permits more realistic assumptions for the misload analysis, which in turn improves the effectiveness of taking credit for burn-up. Finally, the risk-informed defense-in-depth approach would permit the following clarifications that are desired for details in performing the misload analysis:

- The draft guidance permits "...an appropriate administration margin that is not less than 0.02Δk" provided "An adequate justification, that includes the level of rigor in the evaluations and benchmark methods, should accompany the use of any administrative margin that is less than the normal 0.05Δk". A misload is not a normal or even off-normal event, and should be considered in the manner that accident conditions are considered. Specifically, an evaluation of a misload should recognize that a misload is a highly unlikely event, as prevented by the administrative procedures, and that there is substantial conservatism in the criticality analyses. Based upon these considerations, we recommend that the guidance remove the statement on "adequate justification" in favor of generically granting an administrative margin of 0.02Δk for misload analyses. Furthermore, it is not clear what the NRC considers to be an adequate justification, nor how the level of rigor would impact the justification. All criticality analyses that meet NRC regulatory standards are necessarily conservative, and this is not dependent upon the rigor (interpreted as precision) of the analyses (i.e. less precise analyses would necessarily need to incorporate more conservative assumptions). If the term "rigor" is intended to mean "conservatism" rather than "precision", then it is suggested that "rigor" be replaced with "conservatism".

- Single Misload – We agree that a single misload analysis is desirable as it provides defense-in-depth to the prevention of misloads provided by administrative procedures by ensuring that a single misload would remain subcritical. This is justified since a single misload, although highly unlikely, could be caused by a human error and result in one of the three misload conditions. In this regard, the assumptions of the misloaded assembly should be developed on a risk informed basis which considers the risk reduction of a single misload event through the administrative procedures. However, the proposed assumptions in the draft guidance are overly complex, and the intent and definition of a "severely underburned assembly" to assume for the single misload is not clear. We recommend a simpler, more bounding assumption for the single misload of "the most reactive fresh fuel assembly in the most reactive cask location". Since this is an extremely conservative assumption, it is also recommended that the guidance explicitly state that alternative assumptions for the single misload assembly may be acceptable if justified by consideration of realistic fuel characteristics in the pool and/or administrative procedures.
- Multiple Misload – A multiple misload analysis may also be prudent depending upon the specific conditions of the cask licensing basis. This recognizes that multiple misloads only occur as a result of a procedural error, and thus are even more unlikely than a single misload caused by a human error. In this regard, the assumptions of the misloaded assembly should be developed on a risk informed basis which considers the risk reduction of a multiple misload event through the administrative procedures. However, the proposed assumptions in the draft guidance are overly complex, and the intent and definition of a "moderately underburned assembly" to assume for the multiple misload is not clear. From the information provided, it appears that this would require extensive resources to perform and would be difficult for licensees to verify compliance of fuel loaded into the casks, and as such would be difficult for the NRC to perform a review and oversight. Therefore, we believe a simpler, more realistic, and conservative assumption for the multiple misload which recognizes that the misloaded fuel could have either higher or lower burnup, and considers past operating experience, would be more appropriate. We recommend an assumption of "50% of the fuel being misloaded with assemblies that have burn-up reduced by 25%" should be sufficiently conservative, and is more straightforward for performing analyses and verifying that implementation by licensees is consistent with the cask licensing basis. It is also recommended that guidance explicitly state that alternative assumptions may be acceptable if justified by consideration of realistic fuel characteristics in the pool and/or administrative procedures.

e) We recommend that burn-up measurements be completely removed from the guidance. In-pool burn-up measurements (which is what we believe the guidance means when it discusses burnup measurements) do not accomplish the primary purpose for performing burn-up verification, e.g. it does not prevent a more reactive assembly being loaded,

because it does not address 1) loading the wrong fuel assembly, nor 3) assignment of the wrong burn-up value to a fuel assembly. Nor is it necessary to prevent 2) calculating a burn-up value higher than actual, since this situation is already prevented by the reduction of the reactor record burn-up by its uncertainty (our recommended administrative procedure #4). Further reduction of the burn-up by the measurement uncertainty unnecessarily adds additional conservatism as it accounts for the inaccuracy of the measurement (which is typically less accurate than reactor records) and the reactor record a second time, (since the measurement uncertainty is determined using reactor records). Solely relying on the reactor records is justified as they are very accurate (typically on the order of 2% uncertainty), and have a long history of use and acceptance by NRC for reactor operations and spent fuel pool storage. In fact, reactor records do constitute a burn-up measurement as defined in the draft guidance, which permits a sampling method. Roughly 1/3 of the core is directly measured and the in-core measurements are compared to code predictions to determine their accuracy. However, it is noted that burnup cannot be measured directly and both in-core and in-pool measurement techniques rely on the benchmarking of the actual parameter measured (e.g. gamma flux) to predictions of burnup using computer codes that model the core's operation. In this respect, in-pool measurements do not have an increased pedigree or value compared to in-core measurements. Finally, in-pool burn-up measurements are difficult to perform, result in worker dose and costs, as well as diverting resources away from activities that are more important to safety.

2. More flexibility to use alternative methods for code validation for burn-up credit

Guidance that includes more flexibility to use alternative methods for code validation (Section 3 "Code Validation – Isotopic Depletion", and Section 4 "Code Validation – K_{eff} Determination", pages 3-6) would ensure safety and regulatory compliance, while also ensuring efficient use of industry and NRC resources. The draft guidance endorses the methods for code validation for burn-up credit documented in NUREG/CR-7108 and NUREG/CR-7109; however, it is not evident from the draft guidance that the NRC would accept alternative methods if appropriately justified. Alternative methods for performing the code validation for burn-up credit may become available, in fact, an alternative method currently exists and was published by EPRI in 2011, "Benchmarks for Quantifying Fuel Reactivity Depletion Uncertainty – 1022909". Industry has expressed interest in utilizing this method for code validation for burn-up credit. We recommend that the guidance be improved to be clear that alternative approaches can be proposed by applicants, and if sufficiently justified, approved by the NRC, and we request that guidance be improved as follows:

a) Reformat the guidance such that Sections 3 and 4 are combined into a single section, i.e. "Section 3. Code Validation for Burn-up Credit", and the specific delineation that is described in the draft guidance would be subsections, i.e. "Section 3.1. Isotopic Depletion" and "Section 3.2. K_{eff} Determination". This provides clarity that code validation for burn-up credit is composed of these two major elements, and provides greater flexibility for alternatives that may not be as readily separated into these categories.
b) In reformatting Section 3, an introductory paragraph should be included prior to the sub-sections. We recommend, and believe it is essential, that the introductory paragraph

explicitly state that "Code validation for burn-up credit should include validation of both the depletion code and the criticality code for depleted conditions. These may be performed separately or together. An acceptable approach for performing code validation for burn-up credit would include the methods described in both Sections 3.1 and 3.2. Alternative approaches, including those that do not rely on radiochemical assay data, may be found acceptable if appropriately justified."

3. More flexibility to credit additional isotopes beyond those listed in the guidance

Guidance that includes more flexibility to credit additional isotopes beyond those listed in the guidance (Appendix A: Section 3 "Limits for Licensing Basis: Nuclides of Importance", pages A-3 to A-4) would ensure safety and regulatory compliance, while also ensuring efficient use of industry and NRC resources. The draft guidance currently limits the actinides and fission products to those listed in Tables A-1 and A-2 (as stated in Section 4 "Code Validation – K_{eff} Determination", pages 5-6). While the nuclides permitted are those with the most impact on reactivity, this set does not represent full burn-up credit. The guidance should include a more explicit basis for determining which nuclides can be credited, which would also allow for credit of additional nuclides if appropriately justified. This would provide flexibility for an applicant to propose an alternative method, or augmented method to that endorsed in the guidance, that includes full burn-up credit. In this regard, we recommend the guidance be improved to explicitly state (in the earlier recommended Section 3 on code validation for burn-up credit) that "Nuclides included as part of burn-up credit for criticality analyses should be included in the code validation. Nuclides that are not included in the code validation would need to be justified. Assumptions, if demonstrated to be conservative, may be considered appropriate justification." Including this statement would also improve the viability of the approach endorsed in the draft guidance.

4. More flexibility to apply a similar burn-up credit approach to BWR fuel

Guidance that includes more flexibility to apply the guidance on burn-up credit outlined in ISG-8 Revision 3 to BWR fuel would ensure safety and regulatory compliance, while also ensuring efficient use of industry and NRC resources. It is recognized that ISG-8 has been developed specifically for burn-up credit of PWR fuel; however, there is no fundamental reason precluding burn-up credit for BWR fuel. While there are some differences between the depletion of BWR fuel and PWR fuel, the similarities are numerous and much of the draft guidance could also be applied to BWR fuel burn-up credit. We recommend that the guidance explicitly acknowledge the potential for an applicant to take credit for burn-up for BWR fuel, and that consideration of ISG-8 may be useful to applicants developing an approach for NRC review and approval. In this regard, we recommend the following be explicitly stated in the guidance (i.e. in the Introduction, second paragraph, second sentence) "While this revision to ISG-8 does not specifically provide guidance for taking burn-up credit of BWR fuel, such an approach could be found acceptable if appropriately justified, and should consider the portions of this ISG that are also applicable to BWR fuel." While we are not specifically requesting the unique aspects of BWR fuel, as they relates to burn-up credit, to be included in ISG-8 at this time, such guidance may be desired in the future.

5. Better organize guidance to align with its various uses

We recommend that the guidance's use of the main body and Appendix A of the guidance be improved to better align with the dual uses by 1) NRC staff, and 2) applicants, licensees and CoC holders. Ease of understanding and use of the draft guidance could be improved if these two parts of the document have well defined purposes. This would also eliminate two attributes of the draft guidance that increase its complexity: 1) that some content is duplicated between these two parts of the document, and 2) that some parts of the main body cannot be fully understood without referring to the Appendix.

We recommend that the purpose of the main body's "Recommendations" section be used for the purpose of providing guidance to NRC staff on what content should be included in an application. In this regard, the section could be retitled "Staff Guidance", and accordingly much of the details that are used by applicants to develop the content of the submittal that is currently in the Recommendations section should be relocated to Appendix A. This would result in Appendix A containing all of the guidance that is intended for applicants, and could be more appropriately titled "Use of Burn-up Credit for Spent Nuclear Fuel Transportation Packages and Storage Casks". This recommendation further supports our earlier comment that the NRC should consider developing a Regulatory Guide at the time when guidance for staff is incorporated into the Standard Review Plans, as it provides the defined separation of the content that would ultimately be incorporated into these two guidance documents.

As an example on how this concept could be applied to the draft guidance: The discussion in Section 5 on Administration Procedures could be focused on guidance to staff by stating "Staff should confirm that there is adequate assurance that the administrative procedures will ensure that the SNF storage or transportation system will be loaded with fuel that is within the specifications of the approved contents. Appendix A Section 7 describes one approach to Administrative Procedures that is acceptable. Alternatives may be found acceptable if appropriately justified." Then, Appendix A Section 7 would describe the approach acceptable to staff, e.g. the seven procedures recommended in comment #1.b.

Attachment
Industry Comments on draft ISG-8 Revision 3 "Burnup Credit in the Criticality Safety Analyses of PWR Spent Fuel in Transport and Storage Casks"
(DOCKET ID NRC-2012-0100)

Additional Detailed Comments

Comment#	Page, Section	Comment/Proposed Change
6	General	We recommend that the guidance be improved by including a section describing the regulatory basis. It is noted that other Interim Staff Guidance documents include this discussion, and it provides clarity and completeness to the overall guidance. In this regard, the "Regulatory Basis" section, which could be included between the "Introduction" and "Applicability" sections, should cite the applicable regulations for which the guidance is establishing an NRC position. These regulations may include: 71.55(b), 71.55(d)(1), 71.55(e), 72.124(a), and 72.236(c).
7	General	We recommend that the guidance be improved by expanding the discussion on "Applicability". It is noted that other Interim Staff Guidance documents include a discussion on the applicability of the ISG to the existing Standard Review Plans in the "Applicability" section, which provides clarity and completeness to the overall guidance, as well as preventing the possibility for conflicting guidance. In this regard, the "Applicability" section should be expanded to explain to which Standard Review Plans (and the specific sections) ISG-8 applies, and how it applies. This may include the following: • SRP NUREG-1536, Section 7.5.5: replaced in its entirety by ISG-8 Revision 3 • SRP NUREG-1567, Section 8.4.5: replaced in its entirety by ISG-8 Revision 3 • SRP NUREG-1617, Section 6.5.8: replaced in its entirety by ISG-8 Revision 3
8	General	We recommend that the guidance be improved by including a section listing the acceptable codes and standards, if any. It is noted that other Interim Staff Guidance documents include this discussion, and it provides clarity and completeness to the overall guidance. In this regard, if the NRC intends to accept the standards referenced in the draft guidance as one acceptable approach, then the "Acceptable Codes and Standards" section, which could be included between the "Introduction" and "Applicability" sections, should cite the applicable codes and standards that the draft guidance is endorsing.
9	p.1, Applicability	We recommend that the guidance be revised to state that the applicability is also to "undamaged" fuel, and not only "intact" fuel. This is needed to be consistent with the NRC recommendation in ISG-1 Revision 2, page 9. It would also be helpful to include a discussion on the basis why the applicability is not readily extended to "Damaged" fuel, so that applicants will be able to understand the concern, or unique aspects, that must be addressed in a proposed approach for burn-up credit for these conditions of fuel.

10	p. 2, 1st Phg under 1. "limits for the Licensing Basis	This ISG will be applicable to any Part 72 Site Specific Storage license that will incorporate burnup credit into their criticality analyses. Site Specific Licenses typically do not have a Certificate of Compliance associated with them. Thus, they do not have "certificate conditions". Please change this to "certificate or license conditions".
11	p. 2, 1st Phg under 2. "Licensing- Basis Model Assumptions (also affects Pg A-6 through A-11	Please provide clarification regarding which inputs may be "representative" and which should be bounding. Some of the input items listed here have a 2nd or 3rd order affect on the analysis and thus representative values should be acceptable while others (1st order affects) should bound the actual contents of the package.
12	p.3, 1st bullet	While inputs listed here should be accounted for in the analysis, not all can be verified for each assembly loaded into the cask. For example, individuals selecting fuel assemblies to be loaded would not be able to verify the fuel temperature of the fuel assemblies, nor would the specific power be readily available. In addition, these parameters are not constant over the life of the fuel assembly or over the axial height of the assembly. Verification of input parameters should be limited to those that are readily available, such as power level.
13	p.4, 3rd Phg., 2nd sentence	We recommend that the guidance on performing adjustments with regards to control parameters be clarified. Our interpretation is that the intent of this statement is to determine any trends of the bias and bias uncertainty with fuel parameters (e.g. burn-up, enrichment). As such, we believe this statement would be more clear if it were as follows (note the original statement is modified in a strike-out/highlight method) "The burnup credit results should be adjusted using the bias and bias uncertainty determined for the fuel depletion code, *as adjusted for any trends of significance with respect to any* ~~with regards to different~~ control parameters ~~such as~~ *(these might include* enrichment, burnup, and*/or* cooling time)*."* It is noted that NUREG/CR-6811 shows a trend on burnup but does not discuss trends on enrichment or cooling time. We agree that a trend on burnup should be sought and applied as recommended by the ORNL work. The data for seeking an enrichment trend is much thinner especially if the set were required to contain fission products. It is prudent to check for an obvious trend on enrichment but a full statistical approach is not needed. In the range of interest the increase in U-235 should have little impact on the physics. It would be more logical to seek a trend on a spectral index which has more effect on the physics. A trend on cooling time would be difficult to obtain from the chemical assay data. Since the two cooling time changes that are important are the Pu-241/Am-241 and Eu-155/Gd-155 decays then a seeking

		a trend on these ratios may be illuminating.
14	p.5, Tables 1 and 2	Please clarify whether the "burnup range" corresponds to assembly average burnup (if so what axial burnup profile was assumed) or the burnup of a given axial node. The tables should be clarified to state that that these values are the bias uncertainty, and the bias to be used is zero.
15	p.4, bullet at bottom of page	The results mostly depend on the cross section library, and the effect of the depletion code is a second order affect. The final criticality code (KENO vs MCNP) has little if any effect on the results. Please consider relaxing the restriction to "the same depletion code and cross section library.", or providing this possibility if appropriately justified. This will allow the use of MCNP, which for the same isotopic content agrees very well with KENO.
16	p.5, first bullet	It is unclear what the "similar initial assumptions" means, as these will depend on the limiting conditions expected for the fuel to be loaded in the cask. These assumptions are different than using the actual conditions for a chemical assay. If the applicant is using the values in Table 1, then initial assumptions of the chemical assays would not be relevant. Please remove or clarify "initial assumptions." It is unclear what the "code modeling options" means, as NUREG/CR-7108 does not provide input decks from which the code modeling options used could be determined. Is this intended to apply to ENDF/B-V where it is possible to use NITWAL rather than CENTRM and this will produce different results? Please remove or clarify "code modeling options".
17	p. 6, 2nd paragraph	Guidance states "...combined bias and bias uncertainty associated with minor actinide and fission product nuclides of 1.5% of their worth may be used."; however, biases and uncertainties are not directly combined in determining the final k-eff. Biases are added directly to the calculated k-eff, while uncertainties are statistically combined with each other before being added to the calculated k-eff. References to combining biases and uncertainties is repeated later in the same section and may appear elsewhere in the draft guidance. Please correct the references to combining biases and uncertainties, and clarify the values by separating them into their constituent parts.
18	p. A-21, last paragraph, second sentence	We request that the referenced standard not be quoted since the use of the word "shall" in guidance conveys a requirement, and would not be appropriate. In cases where references use

		words such as "shall", it is recommended that the guidance summarize the reference or cite it without direct quotation. In this particular use, we recommend the following citation of the standard "ANSI/ANS 8.1 provides an acceptable method for establishing the bias by correlating the results of critical and exponential experiments with results obtained for these same systems by the calculational method being verified. Other methods may be used if appropriately justified."
19	p. A-3, middle paragraphs (two instances); p. A-19 2nd paragraph (two instances); p. A-24 3rd paragraph (two instances)	The use of "must" conveys that no alternative can be proposed, and in certain context could effectively establish a requirement. It is recognized that many of these uses of "must" in the draft guidance are in conditionals statements (e.g. "In order to…must…"); however, there may be valid alternatives to the absolute condition being imposed by these statements. In these cases, the use of "must" eliminates the applicant's ability to propose such an alternative. For conditional statements where "must" is used, it is recommended to either replace "must" with a softer conditional statement, such as "should"; or to follow such conditions with a statement that alternative approaches may be acceptable if appropriately justified.