

**Application of Guidance to Implement 10 CFR 72.48 (NEI-96-07 Appendix B) - Examples of Potential Realistic Activities Reviewed through the 72.48 Process**  
**Attachment 2 – Example 1 - Change in Structural Analysis**

**Proposed Activity**

Change in computer code from computer code ALPHA to computer code BRAVO. Code ALPHA uses elastic theory methods and code BRAVO uses plastic theory methods. No changes to any SSCs.

**NRC Approved Licensing Basis**

Computer code ALPHA uses elastic theory methods and was previously reviewed and accepted by the NRC for the overpack shell analysis performed by the CoC holder.

CoC, TS and Approved Contents

*Does not include the name of the computer code and does not discuss the structural analysis.*

FSAR

*Describes that code ALPHA was used and includes a description of the analysis method.*

**72.48 Applicability Determination**

*{72.48 applies if Yes is answered to the first question and No is answered to last two questions}*

[NEI B4.1.1]: Does the proposed activity require a change to the ISFSI, cask design or procedure in the FSAR that is more than an editorial change (B4.1.3) and is not a managerial procedure (B4.1.4)?

Response: Yes. The MoE is described in the FSAR and used to demonstrate the acceptability of the overpack shell design, therefore, the activity requires screening under 10CFR72.48 to determine if an evaluation is required.

[NEI B4.1.1 1<sup>st</sup> bullet]: Does the proposed activity require a change in the CoC, including appendices?

Response: No. The activity would not require an alteration to the CoC or Tech Specs.

[NEI B4.1.1 2<sup>nd</sup> bullet]: Does a different regulation provide more specific criteria for accomplishing the proposed activity?

Response: No. The activity falls under FSAR design basis.

Conclusion: 72.48 applies and the proposed activity must be screened.

**72.48 Screening.**

*{72.48 evaluation is required if Yes is answered to any of the following questions}*

1. [NEI B4.2.1.1]: Does the proposed activity involve a change to an SSC that adversely affects a cask FSAR described design function? [NEI Page 36 footnote, and page 38]: Does the proposed activity involve an alteration to a design basis limit for a fission product barrier?

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Response: No, this activity does not involve a change to an SSC, but rather is associated with methods of evaluation.

2. [NEI B4.2.1.2]: Does the proposed activity involve a change to a procedure that adversely affects how cask FSAR described SSC design functions are performed or controlled?

Response: No, this activity does not involve a procedure, but rather is associated with methods of evaluation.

3. [NEI B4.2.1.3]: Does the proposed activity involve an adverse change to an element of a cask FSAR described evaluation methodology, or use of an alternative evaluation methodology, that is used in establishing the design bases or used in the safety analyses?

Response: Yes, as follows:

MoE means the calculational framework used for evaluating behavior or response of the ISFSI facility, cask design, or an SSC. Activities that involve MoEs require evaluation only when used either in UFSAR safety analyses or in establishing the design bases, and only if the methods are described, outlined or summarized in the UFSAR.

A new computer code BRAVO using plastic versus elastic theory methods is being used for evaluating the shell structural acceptability. The use of BRAVO results in a change in methodology because the proposed activity involves replacing a dry storage cask FSAR described evaluation methodology that is used in establishing the design bases or used in the safety analyses.

4. [NEI B4.2.2]: Does the proposed activity involve a test or experiment not described in the cask FSAR, where an SSC is utilized or controlled in a manner that is outside the reference bounds of the design for that SSC or is inconsistent with analyses or descriptions in the cask FSAR?

Response: No. This activity does not involve a test or experiment.

Conclusion: A 72.48 evaluation is required. One or more “yes” answers to the screening questions indicates a 72.48 evaluation is required to be performed. In this case, only Screen question 3 is answered “yes.” When only Screen question 3 is answered “yes”, then only evaluation question 72.48(c)(2)(viii) (change in method of evaluation) is applicable.

MoE means the calculational framework used for evaluating behavior or response of the ISFSI facility, cask design, or an SSC. Activities that involve MoEs require evaluation only when used either in UFSAR safety analyses or in establishing the design bases, and only if the methods are described, outlined or summarized in the UFSAR.

A new computer code BRAVO using plastic versus elastic theory methods is being used for evaluating the shell structural acceptability. The use of BRAVO results in a change in methodology because the

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proposed activity involves replacing a dry storage cask FSAR described evaluation methodology that is used in establishing the design bases or used in the safety analyses.

The proposed activity modifies a MoE and requires an evaluation per 10CFR72.48(c)(2)(viii), and criteria 10 CFR 72.48(c)(2)(i-vii) are not applicable.

**72.48 Evaluation**

*{Prior NRC approval is required if Yes is answered to any of the following questions}*

[NEI B4.3 2<sup>nd</sup> para]: “Criteria (c)(2)(i–vii) are applicable to activities other than changes in methods of evaluation. Criterion (c)(2)(viii) is applicable to changes in methods of evaluation. Each activity must be evaluated against each applicable criterion.”

The proposed activity modifies a MoE and requires an evaluation per 10CFR72.48(c)(2)(viii), and criteria 10 CFR 72.48(c)(2)(i-vii) are not applicable.

Question 8: [NEI 96-07 B4.3.8] Does the activity result in departure from a method of evaluation described in UFSAR used in establishing the design bases or safety analyses?

Response: Yes, as follows:

This activity changes from the ALPHA computer code, using elastic theory methods, to BRAVO computer code using plastic theory method which substitutes a different MoE than previously used.

*There are two (2) options for which an activity by a Licensee or cask certificate holder may vary the Method of Evaluation (MoE) as described in the UFSAR to an extent such that the activity is not considered a departure from the method and does not require prior NRC approval.*

*Licensees or cask certificate holders do not need prior NRC approval (a license amendment or cask CoC amendment) to perform an activity resulting in the following:*

- 1. Modification to one or more elements of the methodology provided the results are essentially the same as, or more conservative than, previous results, or*
- 2. Substitution of a different MoE than previously used, but that has been approved by the NRC for the intended application.*

The evaluation should proceed by addressing the changes to the MoE by determining if the methodology has been previously approved by the NRC for the intended application.

The Licensees or cask certificate holders would evaluate whether or not the MoE change for the overpack shell analysis could be used under 10CFR72.48(c)(2)(viii) without obtaining a license amendment or cask CoC amendment by determining if the proposed MoE has been previously approved by NRC for this intended application. A method is considered “approved by the NRC for intended application” if it is approved for the type of analysis being conducted, and applicable terms, conditions and limitations for its use

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are satisfied. It should be noted that the NRC staff, in reviewing dry cask storage designs, historically has not generically approved methodologies referenced in FSARs for use by other licensees or vendors.

When considering the application of the computer code BRAVO plastic theory method versus the computer code ALPHA elastic theory method, it is necessary to adopt the methodology en toto and apply it consistent with applicable terms, conditions and limitations.

*Previously approved MoEs by the NRC for the intended application would typically follow one of two paths.*

- 1. Through a Safety Evaluation Report, the NRC would approve the use of the methodologies for a given class of ISFSIs or spent fuel storage casks. In some cases, the NRC would accord “generic” approval of analysis methodologies.*
- 2. NRC’s approval would typically be part of an ISFSI or cask design’s licensing basis and limited to a given ISFSI or spent fuel storage cask design and a given application.*

*Only ISFSI licensees or cask CoC holders qualified to perform MoEs can apply methods that have been reviewed and approved by the NRC, or that have been otherwise accepted as part of another ISFSI’s or cask design’s licensing basis, without requiring prior NRC approval. The guidance of Generic Letter 83-11, Supplement 1 may be useful to ISFSI licensees and cask CoC holders as a method to demonstrate that they are generally qualified to perform safety analyses (have a thorough understanding of the methodology.) ISFSI Licensees or cask CoC holders that have not satisfied the guidelines of Generic Letter 83-11, Supplement 1, may, of course, continue to seek ISFSI-specific or cask design-specific approval to use new methods of evaluation, but should do so by seeking prior approval by the NRC.*

The ISFSI licensee or cask CoC holder proposing to use the computer code BRAVO plastic theory method for the overpack shell design (even one generically approved by the NRC) must have a thorough understanding of the MoE, the terms of its existing application and conditions/limitations on its use. This information may be found in the topical report (original license or CoC application or license or CoC amendment request), the SER, and any correspondence between the NRC and the methodology/analysis owner that is referenced in the SER or associated transmittal letter. In some cases, information clarifying the application of the MoE is contained in proprietary submittals to the NRC and not publically available without consulting the original ISFSI licensee or cask CoC holder that was approved to use this MoE.

This MoE uses the computer code BRAVO plastic theory method versus the computer code ALPHA elastic theory method for the overpack shell analysis. The NRC has not accepted the use of the plastic theory method for performing overpack shell structural analysis.

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Conclusion: Prior NRC approval is required because the MoE cannot be considered previously approved for overpack shell structural analysis, and therefore use of computer code BRAVO is a departure from a method of evaluation described in the UFSAR. Prior approval by the NRC is required in the form of a license amendment or cask CoC amendment.

**Additional Considerations**

The following variations to the main example demonstrate how small changes in the specific conditions can result in different conclusions from the 72.48 review.

**Variant 1:**

Should this activity only revise the version of computer code ALPHA being used from 5.6 to 6.0, then the activity would be evaluated only for modifying one or more elements of the MoE. (In some cases, a new version of a code's MoE may be so extensive that the new version must be considered a "substitution of a different MoE than previously used" and should be evaluated as such.) The following process for evaluation would be followed.

*The Licensees or cask certificate holders would determine if computer code ALPHA 6.0 could be used under 10CFR72.48(c)(2)(viii) without obtaining a license amendment or cask CoC amendment by demonstrating that the results are "conservative or essentially the same" as previous results.*

*Results are considered "essentially the same" if they are within the margin of error for the type of analysis being performed. Code improvements that yield more conservative (accurate) results would have a narrower band for margin of error and, therefore, would be considered "essentially the same." Variation in results due to routine analysis sensitivities or calculational differences (e.g., rounding errors and use of different computational platforms) would typically be within the analysis margin of error and thus considered "conservative or essentially the same."*

*Results are considered "conservative" when the analytical results obtained by using computer code ALPHA 6.0 are closer to design bases limits or safety analyses limits (e.g., applicable acceptance guidelines) than those results by using computer code ALPHA 5.6. Gaining margin by changing one or more elements of a method of evaluation is considered to be a non-conservative change and thus a departure from a method of evaluation for purposes of 10 CFR 72.48.*

*To determine whether the new analysis result would be considered "conservative or essentially the same", the licensee or CoC holder may benchmark computer codes ALPHA 5.6 and 6.0.*

*When benchmarking computer code ALPHA 5.6 to determine how it compares to computer code ALPHA 6.0, the analyses that are done must be:*

- *for the same set of conditions to ensure that the results are comparable, and*
- *over the entire range of use for the method.*

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*Comparison of analysis methods should consider both the peak values and time behavior of results, and engineering judgement should be applied in determining whether two methods yield results that are “conservative or essentially the same”. Engineering judgements should be provided with a clearly stated basis such that any reasonably knowledgeable engineer could read it and agree with it.*

*Twenty-four (24) verification computer benchmarks were performed for computer codes ALPHA 5.6 and 6.0 using the same input variables. The results obtained from 20 of the 24 computer benchmarks were compared and found to have exact numerical matches. The results from the 4 remaining computer benchmarks that did not match were further evaluated for the significance of their mismatches. The detailed evaluation of these 4 computer benchmarks were found that the results for 3 differed by less than 1- percent which is within the expected analytical tolerance of computer codes ALPHA 5.6 and 6.0. The remaining computer run of ALPHA 6.0 was determined to result from different user selectable option chosen between the verification scripts for versions 5.6 and 6.0.*

*Conclusion: It is therefore concluded that ALPHA version 6.0 is essentially the same as ALPHA version 5.6 and use of computer code ALPHA 6.0 is not a departure from a described methodology in the UFSAR. Prior review and approval by the NRC is not required.*

Variant 2:

Should this activity revise the computer code ALPHA to the computer code DELTA for the shell structural analysis and computer code DELTA is based on the same theory as code Alpha (elastic theory methods), then the activity may be evaluated only for modifying one or more elements of the MoE for the DELTA computer code. The DELTA computer code should first be evaluated to assure the following, as applicable, to determine if it is the same methodology with updates with one or more elements:

- Uses the same data type of correlation (e.g., direct integration, modal, static)
- Uses the same type of data reduction (e.g., solution routines, analysis engines)
- Uses the same Physical constants or coefficients (e.g., gap and sliding, friction, damping, isotropic vs. anisotropic materials)
- Uses the same type of Mathematical models (e.g., elastic theory vs. non-linear, stick vs. 3-D or shells of revolution models)
- Limitations of the DELTA computer program are consistent with the ALPHA computer program
- Specified factors to account for uncertainty in measurements or data are consistent
- Statistical treatment of results is consistent (e.g., Monte Carlo vs. probability and confidence)
- Same Dose conversion factors and assumed source term(s) are used (ICRP)

*The Licensees or cask certificate holders would determine if computer code DELTA could be used under 10CFR72.48(c)(2)(viii) without obtaining a license amendment or cask CoC amendment by demonstrating that the results are “conservative or essentially the same” as previous results. In this particular variation, a likely approach is to determine if computer code DELTA provides conservative results with respect to Computer code ALPHA.*

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*Results are considered “conservative” when the analytical results obtained by using computer code DELTA are closer to design bases limits or safety analyses limits (e.g., applicable acceptance guidelines) than those results by using computer code ALPHA. Gaining margin by changing one or more elements of a method of evaluation is considered to be a non-conservative change and thus a departure from a method of evaluation for purposes of 10 CFR 72.48.*

*The determination of whether the new analysis result would be considered “conservative or essentially the same” licensee or CoC holder may benchmark computer codes ALPHA and DELTA.*

*When benchmarking computer code ALPHA to determine how it compares to computer code DELTA, the analyses that are done must be:*

- *for the same set of conditions to ensure that the results are comparable, and*
- *over the entire range of use for the method.*

*Comparison of analysis methods should consider both the peak values and time behavior of results, and engineering judgement should be applied in determining whether two methods yield results that are “conservative or essentially the same”. Engineering judgements should be provided with a clearly stated basis such that any reasonably knowledgeable engineer could read it and agree with it.*

*Seven (7) verification computer benchmarks were performed for computer codes ALPHA and DELTA using the same input variables. The results obtained from all 7 computer benchmarks were compared and in each benchmark, computer code DELTA yielded results closer to limits established in the UFSAR than computer code ALPHA for both the peak values and time behavior.*

*Conclusion: It is therefore concluded that computer code DELTA is more conservative than computer code ALPHA and use of computer code DELTA is not a departure from a described methodology in the UFSAR. Prior review and approval by the NRC is not required.*

Variant 3:

Should this activity be revised to use the NRC approved version of computer code ALPHA to re-analyze a change from #8 rebar on 12 inch spacing to #6 rebar on 9 inch spacing, then the activity would proceed as follows. {Note this case is not a change in method of evaluation, but is a change to an SSC}

*The Licensees or cask certificate holders would verify change in rebar size and spacing meet applicable codes and standards committed to in the UFSAR. In addition, the Licensees or cask certificate holders would review the NRC SERs on the cask overpack design to determine that no specific NRC acceptance of the structural analysis for the cask overpack design is based on the specific size or spacing of the rebar.*

*Upon conclusion that the NRC acceptance is based on compliance with applicable codes and standards and the new rebar size, spacing and section capacity meets these applicable codes and standards, the Licensees or cask certificate holders could conclude that the planned change in*

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*rebar size and spacing is an input to computer code ALPHA. A change in input to a methodology does not involve an adverse change to an element of a cask FSAR described evaluation methodology, nor use of an alternative evaluation methodology, that is used in establishing the design bases or used in the safety analyses.*

*Conclusion: It is therefore concluded that use of computer code ALPHA to re-analyze a change from #8 rebar on 12 inch spacing to #6 rebar on 9 inch spacing may be “screened out” and an evaluation pursuant to 10CFR72.48(c)(2) is not required.*