

August 8, 2008

Mr. Patrick L. Paquin
General Manager – Engineering
and Licensing
EnergySolutions
140 Stoneridge Drive
Columbia, SC 29210

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE
MODEL NO. 10-160B

Dear Mr. Paquin:

By letter dated December 20, 2007, EnergySolutions submitted an amendment request to the U.S. Nuclear Regulatory Commission for Certificate of Compliance No. 9204. You requested a “-96” designation to the package identification number, the addition of fissile material to the authorized contents, and modification of the approval process for TRU wastes.

In connection with the staff’s review, we need the information identified in the enclosure to this letter. We request that you provide this information by September 5, 2008. Inform us at your earliest convenience, but no later than August 22, 2008, if you are not able to provide the information by that date. To assist us in re-scheduling your review, you should include a new proposed submittal date and the reasons for the delay.

Please reference Docket No. 71-9204 and TAC No. L24162 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3285.

Sincerely,

/RA/

Jessica Glenny, Project Manager
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9204
TAC No. L24162

Enclosure: Request for Additional Information

August 8, 2008

Mr. Patrick L. Paquin
General Manager – Engineering
and Licensing
EnergySolutions
140 Stoneridge Drive
Columbia, SC 29210

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE
MODEL NO. 10-160B

Dear Mr. Paquin:

By letter dated December 20, 2007, EnergySolutions submitted an amendment request to the U.S. Nuclear Regulatory Commission for Certificate of Compliance No. 9204. You requested a “-96” designation to the package identification number, the addition of fissile material to the authorized contents, and modification of the approval process for TRU wastes.

In connection with the staff’s review, we need the information identified in the enclosure to this letter. We request that you provide this information by September 5, 2008. Inform us at your earliest convenience, but no later than August 22, 2008, if you are not able to provide the information by that date. To assist us in re-scheduling your review, you should include a new proposed submittal date and the reasons for the delay.

Please reference Docket No. 71-9204 and TAC No. L24162 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3285.

Sincerely,
/RA/
Jessica Glenny, Project Manager
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9204
TAC No. L24162

Enclosure: Request for Additional Information

G:\SFST\Glenny\10160B RAIs.doc

OFC:	SFST	E	SFST	E	SFST		SFST		SFST		SFST	
NAME:	JGlenny		VWilson LC for		MPanicker		PLien		LCampbell		MWaters	
DATE:	7/18/2008		7/18/2008		7/18/2008		7/18/2008		7/18/2008		8/1/2008	
OFC:	SFST		SFST									
NAME:	MDeBose		EBenner									
DATE:	8/6/2008		8/8/2008									

C = COVER

E = COVER & ENCLOSURE

N = NO COPY

OFFICIAL RECORD COPY

Request for Additional Information
EnergySolutions
Docket No. 71-9204
Certificate of Compliance No. 9204
Model No. 10-160B

By application dated December 20, 2007, EnergySolutions requested an amendment for the Model No. 10-160B. This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with its review of the amendment. The requested information is listed by chapter number and title in the applicant's safety analysis report. NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material," was used by the staff in its review of the application.

Each individual RAI describes information needed by the staff for it to complete its review of the application and/or the SAR and to determine whether the applicant has demonstrated compliance with the regulatory requirement.

Chapter 1 Introduction

- 1-1 Evaluate the void volume change due to the fabrication tolerance changes in Drawing No. C-110-D-29003-010, Sheet 2 of 5, Revision 14, Note 16, particularly the inner diameter and outer diameter of cask body and size of lid stepped diameters gaps.

The fabrication tolerance change could affect the calculation of minimum void volume in the release analysis. The staff needs to know the impact to void volume due to the fabrication tolerance change.

This information is needed to determine compliance with 10 CFR 71.33, 71.43(d).

Chapter 3 Thermal

- 3-1 Justify the assumption that the decay heat load for all thermal and other analyses is 200 watts in spite of the inclusion of 325 fissile gram equivalent (FGE) fissile materials with plutonium in excess of 20 Ci in solid form in the package contents. Provide the calculations that verify the assumption of 200 watts decay heat.

EnergySolutions' letter states that, "EnergySolutions is revising the contents to include up to 325 FGE of fissile material. Also, plutonium in excess of 20 Ci is required to be in solid form." Section 1.2.3.1, Cask Contents, lists as item number five, "Transuranic Waste (TRU) with not more than 325 FGE of fissile radioactive material up to a maximum of 3000A₂. In spite of the addition of TRU not exceeding 325 FGE of fissile materials up to a maximum of 3000A₂ to the package contents, the assumed decay heat used in the thermal analysis remains at 200 watts, which is the same as that is assumed in the original SAR.

This information is needed to determine compliance with 10 CFR 71.15, 71.33, and 71.64.

- 3-2 Justify the use of the older version of ANSYS finite element code (version 5.2, 1996) for thermal evaluation of Model No. 10-160B transportation package for both normal conditions of transport (NCT) and hypothetical accident conditions (HAC). Demonstrate that this version is validated for this heat transfer analyses given new information or data that has been incorporated since this version.

Energy Solutions used an earlier version 5.2 (1996) of ANSYS code for its thermal analysis of CNS 10-160B. The current version of ANSYS is version 11. While recognizing the fact that ANSYS code is suitable for thermal analysis of transportation package, the staff finds that the code version used by the licensee is neither supported by the code developer nor the staff will be able to verify the results of the analyses by using the most recent version of the code. The staff has compared the results from earlier version of ANSYS with those from the latest release of ANSYS for some other heat transfer applications, and found that there may be significant variation in the results in some cases.

The applicant should verify that the thermal performance of the CNS 10-160B package during NCT and HAC remains as predicted with ANSYS 5.2, remains valid for this “-96” approval request. The applicant is expected to provide the staff with the details of any new calculations, if performed, to support compliance with the applicable regulations (see ISG-21).

This information is required to verify the licensee's compliance with 10 CFR 71.71 and 71.73.

Chapter 4 Containment

- 4-1 Justify the assumption that the cask curie content ($3000A_2$) in Section 4.2.1 remains valid as the content has changed to 325 FGE and Plutonium more than 20 Ci.

EnergySolutions requested inclusion of fissile material contents up to 325 FGE and possible Plutonium exceeding 20 Ci. The staff needs to know whether the $3000A_2$ Ci content assumption in the containment analysis remains valid.

This information is needed to determine compliance with 10 CFR 71.33, 71.15.

- 4-2 Clarify the maximum allowable leakage rate for leak tests.

The maximum allowable leakage rate in Section 4.2.1 is $3.25e-6$ ref-cm³/sec according to the release analysis provided. However, in Section 4.9.2, the SAR specifies the periodic leak test acceptance criterion as $1.0e-7$ atm-cm³/sec of air (leak tight). The reason for this discrepancy is unclear.

This information is needed to determine compliance with 10 CFR 71.33, 71.51.

- 4-3 Describe the current approval process to determine the acceptability of TRU waste from a particular shipping site in Appendix 4.10.2, Section 1.0, “Introduction.” Provide a comparison between the current approval process and the amendment request.

In this amendment, EnergySolutions requests to revise the approval process to give the Model No. 10-160B user responsibility for determining the acceptability of TRU waste from a particular site. The specific revision includes site-specific evaluation and documentation of the evaluation in a Model No. 10-160B TRU payload assessment document. The staff needs information of the current approval process and a comparison of two approval processes.

This information is needed to determine compliance with 10 CFR 71.33.

- 4-4 Provide the conditions to apply the measurement and sampling method of compliance, particularly the payload parameter of decay heat and hydrogen generation rate.

In Appendix 4.10.2, Section 2.2, payload parameters compliance method includes sampling and measurement, Sections 2.2.6 and 2.2.7, respectively. These methods are stated as an independent verification of compliance. In the decay heat and hydrogen generation rate, the applicant relies mainly on the calculation and process knowledge. The applicable conditions to apply these two methods for all content codes should be provided.

This information is needed to determine compliance with 10 CFR 71.33, 71.43(d).

- 4-5 Provide the basis of the 4-liter threshold that a sealed container requires a known, measured or calculated hydrogen release rate or resistance for shipment.

The staff is not clear on the basis for the 4-liter threshold discussed in Appendix 4.10.2, Section 4.0, "Physical Form Requirement."

This information is needed to determine compliance with 10 CFR 71.33, 71.43(d).

- 4-6 Provide the justification of using different methodology for CH-TRU and RH-TRU in determining maximum allowable decay heat limit in Appendix 4.10.2, Section 10.4. Clarify whether waste handling condition (CH-TRU or RH-TRU) is the only criterion to apply this specific methodology.

The decay heat limit for CH-TRU is calculated through the relationship of hydrogen generation rate and effective G-value. However, the RH-TRU maximum decay heat limit calculation involves radionuclide contents, decay mechanism, shipping period, scaling of hydrogen gas generation rate, etc. The reasons behind the different methodology are unclear. In the site specific payload appendices (Appendix 4.10.2.1 to 4.10.2.5), some content codes do not specify whether the waste handling condition is CH-TRU or RH-TRU. The staff needs the criteria to apply these two methodologies.

This information is needed to determine compliance with 10 CFR 71.33, 71.43(d).

- 4-7 Provide the criteria of meeting the hydrogen gas generation rate limit through decay heat limits.

In the site-specific compliance methodologies in Appendix 4.10.2.1 to 4.10.2.5, the decay heat limit compliance method is used as an option to demonstrate the compliance of hydrogen gas generation rate limit in some content codes. While in some content codes, both the decay heat limit compliance and hydrogen gas generation rate limit compliance are evaluated. In some content codes, only the compliance of hydrogen gas generation rate limit is provided. The staff needs the criteria of applying decay heat limit compliance in these content codes.

This information is needed to determine compliance with 10 CFR 71.33, 71.43(d).

- 4-8 Provide justifications of applying different compliance methods, as noted in Appendices 4.10.2.1 through 4.10.2.5, toward the decay heat limit and hydrogen gas generation rate

limit in different sites. Address the applicable condition for various methods and estimate deviation between the methods. Also, discuss the following site specific approaches:

- (1) Explain the reason of choosing TRUPACT-II methodology in calculating the decay heat for MURR TRU waste.
- (2) Explain the reason of choosing the measurement method to demonstrate compliance of decay heat limit in LLNL.
- (3) Explain the reason for no detail decay heat error estimation except for MURR.

This information is needed to determine compliance with 10 CFR 71.33, 71.43(d).

Chapter 5 Shielding

Provide the following information regarding the proposed additional contents of the Model No. 10-160B:

- (a) Identification and maximum radioactivity of radioactive constituents.
- (b) Identification and maximum quantities of fissile constituents.
- (c) Chemical and physical form of radioactive constituents.

This information is needed to determine compliance with 10 CFR 71.33(b).

- 5-1 Explain how the radioactive contents will be controlled such that neutron and gamma sources are not shipped together.

Clarify the statement in Section 5.2.1, which states “A mixed gamma and neutron source will also comply as the sum of the gamma and neutron dose rates must be less than the NCT dose limit and thus, as shown for the independently evaluated sources, the HAC limits will be met.” Although it is clear that the HAC limits are met, this does not appear to be the case for NCT. Shipping the allowed gamma and neutron emitting sources together would give doses that exceed the regulator limit for NCT. Since the staff does not have much information about the contents of the Model No. 10-160B the staff does not know if or how these two sources of radiation will be separated.

This information is needed to determine compliance with 10 CFR 71.47(b).

- 5-2 Justify the 20 Ci assumption for the Pu-Be neutron source.

In Section 5.2.3 it states that 325 FGE ^{239}Pu -Be source is equivalent to approximately 20 Ci and continues to say that the neutron source is bounded by the analysis. The basis for the 20 Ci value remains unclear to the staff and therefore the staff cannot verify that it is bounded by the analysis.

This information is needed to determine compliance with 10 CFR 71.33(b)(1).

- 5-3 Provide additional information on the specific neutron source configuration.

The staff recognizes that there may be different reactions and therefore elicit a different spectrum for a homogeneous Pu-Be source versus a non-homogeneous Pu-Be mixture. In addition the source can also depend on the plutonium isotope assumed. The staff viewed the reference for the source spectra (Cember) but did not find any information on the source configuration. The staff is unsure that the spectrum is conservative or representative of what will be stored in the Model No. 10-160B.

This information is needed to determine compliance with 10 CFR 71.33(b)(1).

- 5-4 Justify the use of the cask nominal values for the SCALE model used to perform the shielding evaluation.

The shielding evaluation was performed using nominal cask dimensions. Justify the use of nominal dimensions rather than accounting for manufacturing tolerances.

This information is needed to determine compliance with 10 CFR 71.41(a).

- 5-5 Justify the positioning of the point source for NCT.

The staff does not find that assuming the source is at the center is necessarily limiting or realistic. Without knowing the exact contents of the waste package, it is possible to concentrate a source near the edge under NCT.

This information is needed to determine compliance with 10 CFR 71.41(a).

- 5-6 Provide additional information on the exact location of the dose points used for the shielding analysis.

Although Section 5 of the SAR specifies that the dose is calculated at the external surface of the side or top/bottom of the package, it does not give any information as to where along the side or top/bottom or if an average was taken, etc. The location of the dose point could give different, less conservative, results depending on where it is and how it is treated. The staff notes that review of the SAS4 input deck shows multiple point and surface detectors specified but the staff does not know which one was selected for the analysis.

This information is needed to determine compliance with 10 CFR 71.41(a).

- 5-7 Provide a representative SAS4 output file for the neutron shielding analyses.

This file is needed for the staff to review proper convergence is achieved and that the calculated radiation levels from the output agree with those reported in the application.

This information is needed to determine compliance with 10 CFR 71.47.

- 5-8 Provide additional details about the transport vehicle.

The staff needs information about the transport vehicle including dimensions and positioning of the packages on the vehicle.

This information is needed to determine compliance with 10 CFR 71.47(b)(4).

- 5-9 Provide a drawing or additional clarifying information on the lead shield.

Section 1.1.2 of the SAR says that there is a 1-1/8 inch inner shell made of carbon steel and an outer carbon steel shell of 2 inches with 1-7/8 inch lead in between the two. The staff was able to confirm this for the side (radial thickness) of the lead shield and carbon

steel shells by viewing the referenced drawing. However the drawing lacks information about axial length and position of the shield so the staff is unable to confirm this information. The SAS4 shielding input in Section 5 appears to show that the lead extends to the bottom of the cavity. The MCNP input in Section 6 appears to show that the lead shield extends 1 inch below the stainless steel liner and the top is even with the stainless steel liner.

This information is needed to determine compliance with 10 CFR 71.33.

- 5-10 Provide additional information addressing the issues in estimating streaming using SAS4.

The staff notes that the SAS4 code has some limitations due to the use of 1-D adjoint flux in the creation of automated biases. Specifically the code has problems in estimating particle streaming through such voids. The Model No. 10-160B has a streaming path where the lead slump occurs. The staff reviewed the SAS4 input deck but did not find where or how this streaming deficiency was compensated for. Reference page 4 of the January 2003 SCALE newsletter, http://www.ornl.gov/sci/scale/news/scale_27jan2003.pdf.

This information is needed to determine compliance with 10 CFR 71.47.

Chapter 6 Criticality

- 6-1 Provide design information about the drums that will be contained within the Model No. 10-160B, including tolerances. Provide information on whether the drum design tolerances were considered in the criticality analyses.

The staff does not have any information about the drums. The staff acknowledges that no credit is taken for the geometry of the drums; however certain parameters important for criticality are based on the drum volume, such as the amount of CH₂ and the amount of beryllium. Verification is necessary to determine that tolerances for the drums are appropriately accounted for.

This information is needed to determine compliance with 10 CFR 71.33.

- 6-2 Provide additional information regarding the proposed contents of the Model No. 10-160B.

(a) Identification and maximum quantities of fissile constituents, (b) chemical and physical form of all package constituents, and (c) extent of reflection, the amount and identity of nonfissile materials used as neutron absorbers or moderators, and the atomic ratio of moderator to fissile constituents are necessary for the staff to perform its evaluation.

This information is needed to determine compliance with 10 CFR 71.33(b).

- 6-3 Identify any established codes and standards used in the criticality design and control.

Although the appropriate regulations were cited within the SAR, established codes and standards used in the criticality design and control were not provided. The staff reviews this to determine an adequate basis for the quality assurance program. Alternatively the staff would like a basis for the quality assurance program with respect to criticality.

This information is needed to determine compliance with 10 CFR 71.31(c).

- 6-4 Provide the applicable information from Section 6.9.1, Reference No. 6, to the criticality evaluation: U.S. Department of Energy (DOE), *Remote-Handled Transuranic Waste Authorized Methods for Payload Control* (RH-TRAMPAC), U.S. Department of Energy, Carlsbad Field Office, Carlsbad, New Mexico. Identify and justify the conversion factors used to determine quantities of fissile isotopes other than Pu-239. Update the SAR to include these conversion factors.

The staff does not have the above cited reference to determine the conversion factors for fissile isotopes other than Pu-239. The staff needs this information to determine what the conversion factors are and that there is an appropriate basis for these conversion factors. In addition the staff needs to determine that they are applicable to the contents of Model No. 10-160B.

This information is needed to determine compliance with 10 CFR 71.33(b)(2).

- 6-5 Provide the applicable information from Section 6.9.1, Reference No. 7, to the criticality evaluation: Neeley, G.W., D.L. Newell, S.L. Larson and R.J. Green, *Reactivity Effects of Moderator and Reflector Materials on a Finite Plutonium System*, SAIC-1322-001, Revision 1, Science Applications International Corporation, Oak Ridge, Tennessee, May 2004.

The above reference is cited as the justification for use of polyethylene as the bounding hydrogenous moderating material. Additionally, this reference is also cited as the justification for using beryllium as the most bounding reflector material. The staff does not have this reference and needs to review the information contained within it to determine that there is an appropriate basis for the amendment request.

This information is needed to determine compliance with 10 CFR 71.55(b)(1).

- 6-6 Provide additional clarifying information on how the most reactive content and dimensions of the fissile sphere were determined.

Specifically the staff is unclear about the statement on page 6-3 of the SAR, third paragraph, "*the volume of the sphere is dependent upon the sum of the Pu-239, beryllium, polyethylene and void volumes.*" Provide information on how the void volumes were determined. For HAC the void volume is filled with water. The staff also needs additional information on how the water volume within the fissile sphere for HAC is determined.

This information is needed to determine compliance with 10 CFR 71.55(b)(1).

- 6-7 Identify and justify the density material composition selected for the water moderator and reflector mixture (Be/CH₂ and Be/CH₂/H₂O) used as reflector and to fill the cavity for both NCT and HAC.

No justification or sensitivity studies were provided to explain why full density water was used to fill the cavity. The staff also does not have any information on the selection of the density including water content of the reflector.

This information is needed to determine compliance with 10 CFR 71.55.

- 6-8 Provide a representative MCNP output file for the most limiting criticality case.

The staff needs to view this file to determine that the multiplication factors from the output files agree with those reported in the evaluation. The MCNP output file also needs to be viewed to verify that the calculation has passed important statistical checks and has appropriate convergence behavior.

This information is needed to determine compliance with 10 CFR 71.31.

- 6-9 Provide justification demonstrating that the position of the fissile sphere within each array element is in the most reactive configuration.

Since the most reactive position for the fissile sphere in each transportation package is non-symmetric (in the lid corner) it is possible that if the casks were placed in an array where the fissile sphere was in a different location for each cask within the array such that the fissile material were all located around the same location, this may be more reactive.

This information is needed to determine compliance with 10 CFR 71.55(b)(1).

- 6-10 Update the SAR to remove/revise the following statement in Section 6.6.1 (page 6-29): "These conditions are applied to a package that has undergone the tests specified in 10 CFR 71.73, which means that credit may be taken for the cask remaining leaktight during accident conditions. However, although the 10-160B cask remains leaktight under the accident-condition tests specified in 10 CFR 71.73, the criticality analysis for arrays during accident conditions conservatively assumes in-flooding of the cask containment."

Section 2.7.4, Water Immersion, of the SAR states that the immersion in water test required by 10 CFR 71.73(c)(5) was not performed because "no fissile materials will be carried in the cask." Although not performing this test has no impact on the criticality analyses since the cask was assumed flooded. The inclusion of the above statement is incorrect and misleading.

This information is needed to determine compliance with 10 CFR 71.7.

- 6-11 Provide a discussion on any trends observed in any of the parameters important in the validation of the criticality code.

In some cases, trends can be seen in the benchmarking data for the criticality codes for certain important parameters (Pu-239/Pu-240 content, AEF, H/fissile ratio, etc). Certain

data sets should be examined individually to determine if there were any noticeable trends with any particular parameters. The staff did not find a discussion of this in the SAR.

This information is needed to determine compliance with 10 CFR 71.35.

Chapter 8

- 8-1 Explain the reason for no thermal acceptance tests to demonstrate the heat transfer capability of the Model No. 10-160B packaging after fabrication and during the service life of the package as described in Chapter 8. Clarify if thermal tests are performed as part of the maintenance program.

The thermal tests may be needed to confirm that heat transfer performance is consistent with the thermal analyses given uncertainties in calculations, fabrication, or aging of the package during its service life. The staff would like to verify that the maintenance program remains adequate to assure packaging effectiveness for this “-96” approval request. If thermal tests are performed, the application should indicate the frequency, method of testing, and the equipments used in the tests.

This information is needed to determine compliance with 10 CFR 71.71 and 71.73.

- 8-2 Update Section 8.2 to clarify the specific leak rate criteria for seal replacements and periodic tests.

Section 8.2 will be referenced as a condition of the certificate of compliance. The information located in Section 8.2 should be revised.

This information is needed to determine compliance with 10 CFR 71.35.