August 26, 2011

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

SUBJECT: CERTIFICATE OF COMPLIANCE NO. 9204 FOR THE MODEL NO. 10-160B PACKAGE

Dear Mr. Paquin:

As requested by your letter dated April 6, 2011, enclosed is Certificate of Compliance No. 9204, Revision No. 17, for the Model No. 10-160B package. Changes made to the enclosed certificate are indicated by vertical lines in the margin. The staff's Safety Evaluation Report is also enclosed.

Those on the attached list have been registered as users of the package under the general license provisions of 10 CFR 71.17 or 49 CFR 173.471. The approval constitutes authority to use the package for shipment of radioactive material and for the package to be shipped in accordance with the provisions of 49 CFR 173.471.

If you have any questions regarding this certificate, please contact me or Pierre Saverot of my staff at (301) 492-3408.

Sincerely,

/RA/

Michael D. Waters, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
  and Safeguards

Docket No. 71-9204
TAC No. L24540

Enclosures:
1. Certificate of Compliance No. 9204, Rev. No. 17
2. Safety Evaluation Report
3. Registered Users

cc w/encl 1 & 2: R. Boyle, Department of Transportation
J. Shuler, Department of Energy
Registered Users

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(Closes TAC No. L24540)

G:SFST\Part 71 Casework\71-9204.r17.letter&ser.doc and 71-9204.r17.doc
ADAMS Package No.: ML112420016

OFC:	SFST	E	SFST	E	SFST		SFST		SFST		SFST	
NAME:	P. Saverot		J. Chang		M. Sampson		M. DeBose		M. Waters			
DATE:	08/01/2011		08/04/2011		08/04/2011		08/08/2011		08/26/2011			

SAFETY EVALUATION REPORT
Docket No. 71-9204
Model No. 10-160B
Certificate of Compliance No. 9204
Revision No. 17

SUMMARY

By application dated April 6, 2011, Energy*Solutions* requested that (i) the maximum content limits for the Model No. 10-160B package be defined for a Co-60 point source, and (ii) a provision for a shipment of low specific activity (LSA) waste within 10 days of preparation, or within 10 days after venting of drums, be added to the Certificate of Compliance (CoC).

NRC staff reviewed the applicant's requests and found that these requests did not affect the ability of the package to meet the requirements of 10 CFR Part 71.

1.0 GENERAL INFORMATION

1.1. Package Description

The applicant has proposed no changes to the Model No. 10-160B package design.

1.2.1 Contents

Staff's Safety Evaluation Report for the Model No. 10-160B CoC, Revision No. 15, explained in detail why specifying maximum allowable contents only in multiples of A_2 was not sufficient. Staff mentioned the following reasons:

(1) Content with a given A_2 value can be any individual or combinations of a variety of radioactive isotopes. Using A_2 as a unit to define the quantity limits of the content does not provide a unique description of the content;

(2) The A_2 value does not tell the nature of the source, i.e., neutron or gamma, nor the energy spectra of the content, and the A_2 value is independent of the shielding performance for the specific source;

(3) The A_2 value is determined by the weighted average of the A_2 value of individual isotopes in the content (Appendix A of 10 CFR Part 71). It is impossible to determine the A_2 value of the content without knowing the actual constituent nuclides in the content;

(4) The A_2 value can be modified with revised regulations independent of the package approvals;

(5) Thermal evaluations rely upon knowing the decay heat of the source. This value is difficult to verify by direct measurement so it is typically calculated based on the individual nuclides allowed in the maximum source specification;

(6) Content's limits in terms of thousands of A_2 will significantly exceed the shielding capability of the package.

Thus, contents cannot be defined as "Type B quantity of radioactive material, not to exceed 3,000 A_2." On the other hand, staff also recognized that it is still appropriate to use A_2 values to (i) provide an appropriate categorization of the package and (ii) limit the prescribed leak rate, i.e., 3000 A_2 in the case of the Model No. 10-160B package.

Attachment 1 to Chapter No. 7 of the application provides a methodology that allows users to determine the maximum allowable source term of the package contents, based on the known source strength, source spectrum, and the specific weight of the contents. For contents with multiple energies or multiple radioactive isotopes, users calculate the fractional dose rate contribution from each energy bin of the source. Thus, condition No. 5(b)(2)(i) of the CoC now states that "the maximum quantity of radioactive material is determined to be the lesser of the quantity found by the methodology described in Attachment 1 to Chapter No. 7 of the application or the 3000 A_2 limit prescribed by the package leak rate."

The applicant requested that the CoC also includes a limitation of the contents for a Co-60 source as follows: "Maximum contents are limited to 0.495 TBq (13.4 Ci) for a Co-60 point source." Staff disagreed with this request because "point sources" are not licensed or certified as contents. Further, the condition as written could have different regulatory interpretations such as (i) there is only a radioactivity limit for Co-60, but only if loaded as a point source; thus no Co-60 limits exist if it is distributed across a waste volume, (ii) only a single Co-60 point source up to 13.4 Ci is allowed in the package, and waste with distributed Co-60 is not allowed, etc. Staff evaluated a 13.4 Ci Co-60 point source using the methodology described in Attachment 1 to Chapter No. 7 of the application. Co-60 emits two gamma rays with energies of 1.17 and 1.33 MeV. Calculations performed by staff show that a 13.4 Ci point source of Co-60 will have an activity lower than the maximum activity allowed by the point source curve. Therefore, the staff finds that there is no need to include any specific activity limit on Co-60 as a point source in Condition No. 5(b)(2)(i), since the limit is already bounded by the point source curve.

Condition No. 5(b)(2)(i) of the CoC, as now written, includes de facto the maximum activity value for Co-60 as a point source as found from the point source curves corresponding to the shielding analysis.

2.0 STRUCTURAL EVALUATION

The applicant has proposed no structural changes to the Model No. 10-160B package design.

3.0 THERMAL EVALUATION

The applicant has proposed no thermal changes to the Model No. 10-160B package design.

4.0 CONTAINMENT EVALUATION

The applicant has proposed no containment changes to the Model No. 10-160B package design.

5.0 SHIELDING

The applicant has proposed no shielding changes to the Model No. 10-160B package design.

6.0 CRITICALITY EVALUATION

The applicant has proposed no changes to the authorized fissile contents for the Model No. 10-160B package.

7.0 PACKAGE OPERATIONS

The applicant requested staff to review and re-insert in the CoC one of the conditions of the CoC Rev. No. 14, specifically related to the shipment of LSA waste materials. The staff reviewed Information Notice (IN) 84-72, the Safety Analysis Report for the Model No. 10-160B package (Rev. 0) and its accompanying Safety Evaluation Report, as well as some of the referenced reports of BNL-NUREG-28682, NUREG/CR-2830, and DOE GEND-041 (issued by EG&G Idaho, Inc., in 1986). The staff also performed a confirmatory analysis to validate this request. The staff's findings are delineated below:

(1) The staff reviewed IN 84-72, and related reports such as BNL-NUREG-28682 "Review of Recent Studies of the Radiation Induced Behavior of Ion Exchange Media (1980)," NUREG/CR-2830 "Permissible Radionuclide Loading for Organic Ion Exchange Resins from Nuclear Power Plants (1983)," and DOE GEND-041 "A Calculational Technique to Predict Combustible Gas Generation in Sealed Radioactive Waste Containers (1986)." The staff confirmed that the 10-day condition for shipment of LSA materials, as mentioned in IN 84-72, was (i) first established by on-site sampling tests and measurements from a DOE/NRC joint gas generation research program started after the Three Mile Island (TMI) accident and, (ii) further validated by analyses which addressed the correlation of hydrogen generation with the storage time period of LSA materials. As a result of its review, the staff confirmed that the 10-day condition had an appropriate technical basis.

(2) An NRC approved Type B Package for LSA material with a dose rate greater than 1 Rem/hr at three meters from the unshielded source is required by 49 CFR 173.427 while a DOT approved Industrial Package is allowed for LSA material with a dose rate less than 1 Rem/hr at three meters from the unshielded source. Staff reviewed the methodology developed by the DOE/NRC joint gas generation research program and concluded that the potentially different packages used to ship LSA material should not affect the hydrogen generation methodology (including those parameters used in the calculations) which conservatively predicts a low hydrogen generation within twice the

shipping period. In view of the performed analyses, the staff validates that there is no safety concern with hydrogen generation in a package if LSA material shipment takes place within 10 days of preparation or within 10 days after venting.

(3) Given the LSA material's characteristics and corresponding properties for radiolytic reactions, there should be no significant chemical, galvanic, or other reactions with LSA material, as required by 10 CFR 71.43(d). Even if some organic material is contained in the LSA waste, the quantity of hydrogen generated through radiolysis will be very limited if the package is shipped within the 10-day condition.

(4) The staff performed a confirmatory analysis of hydrogen generation with LSA material in the Model No. 10-160B package. The bounding analysis was performed using the maximum decay heat (200 watts), the maximum allowable limit of hydrogen in volume (5%), the maximum energy emission and absorption fraction (1.0), and the conservative effective G value in radiolysis (0.6 molecules per 100 eV for LSA material) to minimize the allowable shipping time for hydrogen generation. Calculations were performed with the weight fractions of water, 1% and 2%, respectively, contained/absorbed in the LSA materials. Both calculations show that (i) it would take significantly longer than 100 days to reach the 5% hydrogen generation limit for the LSA material, and (ii) it should not generate hydrogen above the 5% limit, if the package is shipped within the 10-day condition.

Based on these findings, the staff accepts the applicant's request to re-insert the 10-day condition in the CoC and concludes that the operating procedures both meet the requirements of 10 CFR Part 71 and are adequate to assure the package will be operated in a manner consistent with its evaluation for approval.

8.0 ACCEPTANCE TESTS AND MAINTENANCE PROGRAM

The applicant has proposed no changes to the acceptance tests and the maintenance program.

CONDITIONS

The conditions specified in the Certificate of Compliance have been revised to incorporate several changes as indicated below:

Item No. 3.b has been revised to identify Energy*Solutions*' request dated April 6, 2011.

Condition No. 5(b)(2)(i) has been revised to clarify the definition of the maximum quantity of material per package: the maximum quantity of radioactive material is determined to be the lesser of the quantity found by the methodology described in Attachment 1 to Chapter No. 7 of the application or the 3000 A_2 limit prescribed by the package leak rate.

Condition No. 8 has been revised to add that for contents with a radioactivity concentration not exceeding that for Low Specific Activity material, the hydrogen concentration can be assumed to be less than 5% provided the package is shipped within 10 days of preparation, or within 10 days after venting of drums or other secondary containers.

CONCLUSION

Based on the statements and representations in the application, as supplemented, and the conditions listed above, the staff concludes that the Model No. 10-160B package design has been adequately described and evaluated and that these changes do not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued with Certificate of Compliance No. 9204, Revision No. 17,
on August 26, 2011.