December 31, 2013

Mr. Tom A. Caine
Site Manager
Vallecitos Nuclear Center
6705 Vallecitos Road
Sunol, California 94586

SUBJECT: SPECIAL AUTHORIZATION FOR SHIPMENT USING THE MODEL NO. 2000 PACKAGE (TAC NO. L24861)

Dear Mr. Caine:

As requested by your application dated November 27, 2013, supplemented December 23, 2013, pursuant to Title 10 of the *Code of Federal Regulations* Part 71, Certificate of Compliance (CoC) No. 9228, for Model No. 2000 package is amended to authorize a one-time shipment as follows:

1. Authorization is for a one-time shipment of nine double encapsulated zircalloy rods containing irradiated cobalt pellets placed in two separators. Total shipment activity is not to exceed 7,000 Ci Co-60 and 100 Ci Zr/Nb-95. A basket support, per Drawing No. 000N2016, Rev. 0, shall be used to hold up the shield plug and material basket inside the barrel rack. The two separators (Drawing Nos.147C8410, Rev. 0, and 147C8411 Rev. 0) along with the basket filler (Drawing No.147C8414, Rev. 0) shall be stacked inside of the material basket (Drawing No. 183C8356, Rev. 3). The basket filler shall be placed in last to keep the segmented rods low in the material basket. The material basket shall be inside of the barrel rack (Drawing No. 66D8066, Rev. 3) specified in CoC Section 5.(a)(3)(iv).

2. All other conditions of CoC No. 9228 shall remain the same.

3. This authorization shall expire on January 31, 2014.

If you have any questions regarding this authorization, please contact me or John Vera of my staff at (301) 287-9165.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/ B. H. White for
Michele Sampson, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9228
TAC No. L24861

Enclosure: Safety Evaluation Report

Tom A. Caine
Site Manager
Vallecitos Nuclear Center
6705 Vallecitos Road
Sunol, California 94586

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Docket No. 71-9228
TAC No. L24861
Enclosure: Safety Evaluation Report
DISTRIBUTION: SFPO r/f BWhite
G:\SFST\JV\GEH-9228-auth.ltr&ser.docx **ADAMS P8 Accession No.: ML13365A138**

OFC:	SFST	SFST	SFST	SFST	SFST	SFST
NAME:	JVera	MDeBose	VWilson	RTorres	ZLi for MRahimi	ACsontos
DATE:	12/17/2013	12/18/2013	12/17/2013	12/23/2013	12/23/2013	12/24/2013
OFC:	SFST					
NAME:	BWhite for MSampson					
DATE:	12/31/2013					

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SAFETY EVALUATION REPORT

Docket No. 71-9228
Model No. 2000
Certificate of Compliance No. 9228

SUMMARY

By application dated November 27, 2013, supplemented December 23, 2013, GE-Hitachi Nuclear Energy (GEH or the applicant) requested an amendment to Certificate of Compliance (CoC) No. 9228 for the Model No. 2000 for a one-time shipment of nine double encapsulated zircalloy rods containing irradiated cobalt pellets placed in two separators, with total shipment activity not to exceed 7,000 Ci Co-60 and 100 Ci Zr/Nb-95.

The CoC No. 9228 has been amended by letter to authorize the shipment based on the statements and representations in the application. The staff concludes that the change does not affect the ability of the package to meet the requirements of Title 10 of the *Code of Federal Regulations* (10 CFR) Part 71.

EVALUATION

The NRC staff (staff) reviewed Reference 1 to determine any structural or materials performance issues for the specific contents and shipping configuration of this one-time shipment under normal conditions of transport (NCT) (10 CFR 71.71) and hypothetical accident conditions (HAC) (10 CFR 71.73) scenarios. After evaluation of the submitted drawings (Attachments 1-6, Reference 1), the staff determined that GEH had not provided reasonable assurance that the material basket (Drawing No. 183C8356, Rev. 3) would be able to withstand the regulatory environment. More specifically, GEH had not provided a proper shear stress analysis to prove that the dowel pin supporting the tungsten plug of the material basket would not fracture resulting in a loss of shielding at the bottom of the source. On December 20, 2013, NRC held a conference call with GEH, in which the staff confirmed that resolution of the special authorization would require assurance that the tungsten plug would remain in place inside the barrel rack during NCT and HAC (Attachment A, Reference 10). GEH opted to design and specify a basket support as an additional shoring component for the material basket. The basket support would geometrically and structurally prevent the bottom tungsten plug from exiting the barrel rack during all transport conditions assuming all non- important to safety (ITS) welds and components were to fail.

On December 23, 2013, GEH provided a structural and geometric analysis (Reference 10) for a material basket support (Drawing No. 000N2016, Rev. 0). GEH assumed the most severe HAC conditions: (1) a bottom drop orientation imparting the highest stress on the basket support, (2) a high accident temperature (400°F), and (3) failure of supporting non-ITS welds. GEH demonstrated a safety factor of greater than 10 under these compressive stress conditions. Buckling was ruled out as a potential failure mode since the basket support is recessed within the barrel rack and is short relative to its diameter. GEH also calculated a 10^{-4} probability for the

basket support exiting the barrel rack during HAC. Their analysis also showed a 10^{-4} probability that the increased basket height would interfere with cask lid closing. The staff considers these analyses as defense in depth complements to previous analysis by GEH, in which the arms of the barrel rack are assumed to fail, essentially rendering them non-ITS (References 6, 9 and 10). The barrel rack drawing also properly identifies the barrel rack liner as a Category A ITS component.

The staff also performed a review of the information submitted in Reference 1 to ensure that it meets the shielding requirements in 10 CFR Part 71. In this application, the applicant requests a one-time shipment of up to 7,000 Ci Co-60 and up to 100 Ci Zr/Nb-95 using the Model No. 2000 package. This package is authorized to ship a much higher amount of Co-60 and Zr/Nb-95 in its most recent revision of the CoC (Reference 2). Events in early 2012 caused the staff to question the correct use of the lead shielding liner as it was being used without the lid. The NRC sent GEH a request for information pursuant to 10 CFR 71.39 on July 23, 2012 (Reference 3) about the use of the lead liner in this configuration in addition to other questions regarding the use of the Model No. 2000. On September 21, 2012, the NRC issued a Confirmatory Action Letter (CAL) requesting that GE suspend use of the Model No. 2000 for any contents requiring use of the lead liner configuration (Reference 4). GEH confirmed that it would suspend use of the lead liner on August 2, 2012 (Reference 5). To address staff concerns, GEH submitted an amendment to the CoC that reduces the allowable contents and includes specific shielding and shoring requirements for these contents (Reference 6). This request is currently under review by the staff. GEH indicated that resolving the open issues related to this request would not allow them to make a specific shipment on-time and has therefore requested the one-time special authorization described in Reference 1.

The staff reviewed Reference 1 to determine if the specific contents and shipping configuration meet NCT dose rate limits in 10 CFR 71.47 for this special authorization request. In support of CoC No. 9228, Rev. 8 (Reference 8), the applicant previously submitted a shielding analysis in Reference 7 that shows that a 130,000 Ci Co-60 source within the barrel rack and material basket (which contain 7 inches of radial steel and 1.25 inches tungsten shielding on the bottom, respectively) meet the dose rate limits in 10 CFR 71.47 under NCT. As this analyzed source activity far exceeds the requested amount of Co-60 for this special authorization request (7,000 Ci), the staff finds that it is bounding as long as the source is shipped within the barrel rack and material basket configuration. Drawings for the barrel rack (Drawing No. 166D8066, Rev. 3, Reference 6) and material basket (Drawing No. 183C8356, Rev. 3, Reference 6) have been updated to include the necessary amount of shielding and the staff finds them acceptable for this special authorization request. Therefore the staff has reasonable assurance that the contents and configuration proposed in Reference 1 meet NCT dose rate regulations in 10 CFR 71.47.

The staff reviewed Reference 1 to determine if the specific contents and shipping configuration meet HAC dose rate limits in 10 CFR 71.51(a)(2) for this special authorization request. The applicant performed a HAC shielding analysis for Co-60 in the Model No. 2000 using the barrel rack and material basket configuration. Details of this evaluation have been submitted to the NRC in References 6, 9, and 10. This analysis uses a line source of 130,000 Ci Co-60. Under HAC the applicant assumes that the arms of the barrel rack fail which cause the rack to slide adjacent to the side of the cask interior and that the source protrudes from the barrel rack in the 2.3 inch empty space between the top of the barrel rack and the bottom of the lid. The applicant uses a dose point 1 meter from the overpack adjacent to the top of the source. The side dose rate limit is the most limiting because it has the least amount of shielding. This dose point was justified in References 9 and 10. In this analysis, 5.6% of the 130,000 Ci source, which

amounts to 7,280 Ci, protrudes into the empty space between the top of the barrel rack and the bottom of the lid. Although this analysis is still under review as part of the CoC amendment in Reference 6 and there are questions regarding the justification for this assumption for the fully loaded package, the staff considers the one-time shipment with the proposed 7,000 Ci of Co-60 bounded by this analysis because this quantity is less than the assumed amount of source assumed to protrude from the barrel rack in the fully loaded package HAC shielding analysis. The evaluated dose rate at 1 meter from the package surface is 0.93 Rem/hr. The applicant uses the ANSI/ANS 6.1.1 flux to dose rate conversion factors. With respect to the 100 Ci of Zr/Nb-95 sources to be shipped with the Co-60 source, the staff finds that the spare capacity of 280 Ci of Co-60 bounds the additional sources of Zr/Nb-95 and their daughter nuclides because Co-60 emits two gamma radiations with much higher energy than Zr/Nb-95 (0.757 MeV + 0.724 MeV gammas from Zr-95 and 0.765 MeV gamma from Nb-95). Therefore the staff has reasonable assurance that the contents and configuration proposed in Reference 1 meet HAC dose rate regulations in 10 CFR 71.51(a)(2).

References 1 and 11 state that the source will be shored by a basket support, two separators and a basket filler in the form of an aluminum plug that ensure that the sources stay within the barrel rack. Although this provides additional safety and protection for the source, the staff does not find that these components are necessary to ensure that the dose rates meet regulatory limits in 10 CFR 71.47 or 10 CFR 71.51(a)(2) as the HAC analysis described above assumes 7,280 Ci protrudes from the barrel rack and bounds the source amount to be held in the barrel rack. However, since the one-time shipment limits the contents to the 7000 Ci Co-60 with 100 Ci of Zr/Nb-75 sources, the staff determines that the shielding analyses assuming the 5.6% protrusion of the source terms into the empty space between the top of the barrel rack and the bottom of the lid bounds the requested contents in the one-time shipment.

Based on the review of the materials and representation provided by the applicant, the staff has reasonable assurance that the special authorization requested in Reference 1 will result in a package that meets the regulatory dose rate limits for all NCT and HAC. This conclusion is based on (1) the geometry, composition and activity of the source, (2) additional shoring racks, basket support and aluminum plug that keep the source within the barrel rack, (3) additional shielding in the barrel rack (nominal dimensions in Drawing No. 166D8066, Rev. 3, show 8.5 inches radial steel versus the required 7 inches (Reference 6)).

Based on the above considerations and additional requirements, the staff concludes that the special authorization requested in Reference 1 for the Model No. 2000 package meets the regulatory requirements of 10 CFR Part 71.

REFERENCES

1. Letter from T. Caine (GEH) to NRC, “GEH Request for Special Authorization to Use the Model No. 2000 Package, Docket No. 71-9228,” November 27, 2013 (ADAMS Accession Nos. ML13344A978 and ML13344A979).

2. Letter from M. Waters (NRC) to D. R. Krause (GEH), “Revision No. 25 of Certificate of Compliance No. 9228 for the Model No. 2000 Package,” May 4, 2011 (ADAMS Accession Nos. ML111240595 and ML11200A101).

3. Letter from M. D. Lombard (NRC) to D. R. Krause (GEH), "Request for Information for Continued Use of the Model No. 2000 Package, Certificate of Compliance No. 9228," July 23, 2012 (ADAMS Accession No. ML12205A258).

4. Letter from M. D. Lombard (NRC) to D. R. Krause (GEH), "Confirmatory Action Letter (CAL) No. NMSS-2012-001," September 21, 2012 (ADAMS Accession No. ML12269A255).

5. Email from C. Martinez (GEH) to P. Saverot (NRC), "Model 2000 Type B Package (CoC 9228)," August 6, 2012 (ADAMS Accession No. ML122270431).

6. Letter from A. McFadden (GEH) to M. D. Lombard (NRC), "GEH Response to Confirmatory Action Letter NMSS-2012-001 and requests regarding the GE2000 Type B Shipping Cask, Certificate 9228, Docket 71-9228, TAC Nos: LA0129 and L24690," July 1, 2013 (ADAMS Accession Nos. ML13182A700 and ML13197A396).

7. Attachment B, "Revised Pages to NEDO-32318," (ADAMS Accession No. ML030900347) to letter from G.E. Cunningham (GE) to C. R. Chappell (NRC), May 30, 1995 (ADAMS Accession No. ML030900274).

8. Attachment, "Certificate of Compliance No. 9228, Rev. No. 8, Model No. 2000 Package" (ADAMS Accession No. ML030860096) to letter from C. R. Chappell (NRC) to G.E. Cunningham (GE), September 15, 1995 (ADAMS Accession No. ML030860091).

9. Letter from T. Caine (GEH) to P. Saverot (NRC), "GEH Response to Second Request for Additional Information for the Review of the Model No. 2000 Package, Docket No. 71-9228, TAC No. L24690," November 15, 2013 (ADAMS Accession No. ML13322A444).

10. Letter from T. Caine (GEH) to P. Saverot (NRC), "GEH Response to Second Request for Additional Information for the Review of the Model No. 2000 Package, Docket No. 71-9228, TAC No. L24690," November 22, 2013 (ADAMS Accession No. ML13329A228).

11. Letter from S. Murray (GEH) to NRC, "GEH Request for Special Authorization to Use the Model No. 2000 Package, Docket No. 71-9228 – Supplemental Information" December 23, 2013 (ADAMS Accession No. ML13357A178).

CONDITIONS

The authorization is limited to the following contents and additional conditions:

1. Authorization is for a one-time shipment of nine double encapsulated zircalloy rods containing irradiated cobalt pellets placed in two separators. Total shipment activity is not to exceed 7,000 Ci Co-60 and 100 Ci Zr/Nb-95. A basket support, per Drawing No. 000N2016, Rev. 0, shall be used to hold up the shield plug and material basket inside the barrel rack. The two separators (Drawing Nos.147C8410, Rev. 0, and 147C8411 Rev. 0) along with the basket filler (Drawing No.147C8414, Rev. 0) shall be stacked

inside of the material basket (Drawing No. 183C8356, Rev. 3). The basket filler shall be placed in last to keep the segmented rods low in the material basket. The material basket shall be inside of the barrel rack (Drawing No. 66D8066, Rev. 3) specified in CoC Section 5.(a)(3)(iv).

2. All other conditions of CoC No. 9228 shall remain the same.

3. This authorization shall expire on January 31, 2014.

CONCLUSION

CoC No. 9228 has been amended by letter to authorize a one-time shipment of nine double encapsulated zircalloy rods containing irradiated cobalt pellets placed in two separators. The shipment is authorized based on the statements and representations in the application. The staff concludes that the change does not affect the ability of the package to meet the requirements of 10 CFR Part 71.

Issued on December 31, 2013