

September 10, 2014

Mr. Christopher Dane
Engineering Manager
Robatel Technologies, LLC
5115 Bernard Drive, Suite 304
Roanoke, VA 24018

SUBJECT: AUTHORIZATION FOR SHIPMENT OF ACTIVATED METALS USING THE
MODEL NO. RT-100 PACKAGE

Dear Mr. Dane:

As requested by your application dated June 3, 2014, as supplemented August 26, 2014, pursuant to Title 10 of the *Code of Federal Regulations* Part 71, Certificate of Compliance (CoC) No. 9365, for the Model No. RT-100 package, is amended to authorize a maximum of 14 shipments of activated steel from the Rancho Seco decommissioning project, as follows:

- (1) Authorization is for a maximum of 14 shipments from the Rancho Seco decommissioning project with contents as follows: (i) Core Barrel Sections, (ii) Thermal Shield Sections, (iii) Upper Grid Sections, (iv) Lower Internals Top and Middle Sections, and (v) Chips generated by the cutting process..
- (2) Payloads shall be either "self-nesting" or stabilized using cribbing to minimize shifting of items during shipments.
- (3) Prior to shipment, package dose rates shall be measured to ensure compliance with 10 CFR 71.47.
- (4) The measurement procedures and locations shall be commensurate with the standard of ANSI N14.36 "Measurement of Radiation Level and Surface Contamination for Packages and Conveyances".
- (5) A 20% safety margin shall be applied for all dose rate measurements to address measurement uncertainties, loose contamination, and minor shifting of contents during transport.
- (6) All other conditions of CoC No. 9365 shall remain the same.
- (7) This authorization shall expire on December 31, 2014.

C. Dane

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If you have any questions regarding this authorization, please contact Pierre Saverot of my staff at (301) 287-0759.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

/RA/

Michele Sampson, Chief
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9365

TAC No. L24925

Enclosure: Safety Evaluation Report

cc w/encl: R. Boyle, Department of Transportation
J. Shuler, Department of Energy, c/o L. F. Gelder

C. Dane

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SAFETY EVALUATION REPORT
Docket No. 71-9365
Model No. RT-100 Package
Authorization for Limited Shipments

BACKGROUND

On June 3, 2014, as supplemented on August 26, 2014, Robatel Technologies, LLC (the applicant) submitted a request for authorization to ship activated steel from the Rancho Seco plant. The applicant stated that such shipments will complete an important milestone of the Rancho Seco Nuclear Generating Station Decommissioning Plan and fulfill a 25-year old commitment made to local residents to remove the Class B and Class C waste that was stored on-site pending availability of a permanent disposal option.

The applicant intends to submit in the near future an amendment request to the current Certificate of Compliance (CoC) to include activated steel components as authorized contents of the package. In the meantime, the applicant requested an authorization for a maximum of 14 shipments of activated steel, i.e., upper grid segments, core barrel pieces, thermal shield pieces, segments of the lower internals and chips generated by the cutting process, from the decommissioning of the Rancho Seco plant.

The technical bases of the request are the detailed surveys that were performed on each liner, and the activation analyses that determined the radioactivity for each segment of the reactor vessel internals (RVI), using flux profiles and the survey data.

EVALUATION

Contents and Design Description

The class B and class C wastes from the decommissioned Rancho Seco reactor include the segments of the reactor internals, i.e., plenum cover, plenum cylinder, control rod guide tubes, upper grid, core support shield, core barrel, thermal shield, lower internals top section, low internals middle section, and low internals lower section.

The packaging to be used for the requested shipments is the Model No. RT-100. A secondary liner is required at all times to shore contents in the cavity. There is no drain port on the package. Licensing Drawing Nos. RT100 PE 1001-1, RT100 PE 1001-2, RT100 PRS 1011, and RT100 PRS 1031 provide details of the design, including the bill of materials and the dimensions of the packaging. Since the staff has previously evaluated the Model No. RT-100 package general shielding design, this review documents only the staff's evaluation of the Model No. RT-100 package with the requested contents from the Rancho Seco decommissioning activities.

Radiation Source Specification

The waste classification of the components and/or component segments of the RVI was performed based on the work done by David James & Associates based on the Co-60 activation with considerations of the material composition, irradiation history (neutron flux and its distribution). The material specification used in these calculations was SS304 stainless steel

and the neutron fluxes at these components were determined using a one-dimensional S_N transport theory computer code ANISN. Activation of other materials in these components was converted to Co-60 equivalent. Therefore, the total radioactivity of these components is given in Co-60 equivalent quantity.

Microshield was used in determining the source radioactivity inside each liner based on the measured dose rate at the surface of each liner with an assumption that the source was uniformly distributed in the content.

Shielding Model

Based on the calculated radioactivity, in 2005, using Microshield for each liner, the applicant further adjusted the source with an appropriate average decay constant based on the waste characterization results. For example, for the irradiated hardware without significant contamination, the decay constant of Co-60 was used to estimate the radioactivity in February 2014.

The applicant performed shielding analyses using the MCNP6.1 computer code. The applicant modeled the package under normal conditions of transport (NCT) and hypothetical accident conditions (HAC) under the tests as prescribed in 10 CFR 71.71 and 71.73, respectively.

The applicant chose the liner containing the maximum activity as the bounding case for the shielding analyses to demonstrate that the Model No. RT-100 package, with the proposed contents, meet the regulatory requirements of 10 CFR 71.47 and 71.51.

For the package under NCT, all contents are explicitly modeled, including the liner. The applicant stated that, with the wood shoring, the liner will sit centered in the package at the bottom of the cavity under NCT. However, the models did not consider potential movement of the contents during transport because the contents (segments of RVIs) are not tightly fit in the liners; there are gaps between the adjacent pieces of the contents.

For the package under HAC, the liner, together with the shoring device, is completely ignored in the shielding model. The model assumes a complete loss of the impact limiter and a one-inch puncture depth into the side lead layer. Two shielding models were developed to address lead slump and the pin puncture; lead slump to the bottom and the side in the HAC models as it was done in the analyses performed to support the original application, as approved by the staff in CoC, Rev. 0.

The Model No. RT-100 package is modeled with full three-dimensional details. The content region is modeled as a uniform source and mass for each RVI segment in the package. The applicant used the MCNP surface tallies at the package surface and point detector tallies at the 1 m from the surface, at 2 m from the planes projected from the edge the transportation trailer, and at the driver seat respectively for a package under NCT. The applicant calculated the dose rates by multiplying the tallies by the ANSI/ANS-6.1.1-1977 flux-to-dose factors. The maximum calculated dose rates are 112.9 mrem/hr on the package surface, and 5.40 mrem/hr at 2 m from the projected surface of the edge of the vehicle for package under NCT. For a package under HAC, the maximum dose rate at 1 m from the surface of the package is 275.63 mrem/hr.

The staff noted that the applicant failed to provide a summary table for the calculated dose rates in the safety analysis report, contrary to the guidance provided in NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material." The staff expects the applicant to include a dose rate summary table similar to Table 5-1 of NUREG-1609 in all future amendment requests.

The requested contents do not include any fissile material or neutron sources (except for typical small quantity contaminants). Thus, neutron shielding is not required.

Evaluation and conclusions

The staff reviewed the description of the package design features related to shielding and the source terms. The staff also reviewed the shielding analyses, the assumptions and approximations used in the analyses, the results of the analysis as presented in the application, and the maximum dose rates for NCT and HAC. The applicant assumed the maximum sources for all segments loaded in the package. Based on its review, the staff determined that the calculated dose rates are below the regulatory limit in 10 CFR 71.47 and 71.51 with reasonable safety margins for an exclusive use package.

The staff noted that there is a significant weakness in the method used to estimate the source term, as shown in Table 3 of the document "RT-100 Transport Cask Contents Description," because some of the measured dose rates are apparently much greater than the calculated ones. Staff also noted that the applicant did not fully address the staff's questions in its responses to the request for additional information.

Nevertheless, the staff noted the conservatism in the source strength and the shielding calculation results and believes that these conservatisms and safety margins are sufficient to offset the deficiency of the source term calculations.

However, there are remaining concerns on uncertainties in the source term distributions because of the inherited deficiency from the method used to calculate the source term and the potential minor movement during transport. In order to ensure safety, the shipper must perform a comprehensive dose rate measurement following the procedures specified in ANSI N14.36 for each shipment to ensure that there is no unexpected hot spots that could possibly exceed the regulatory requirements of 10 CFR 71.47 and 10 CFR 71.51.

A 20% safety margin to the limit will be applied for all dose rate measurements, to address measurement uncertainty, loose contamination, and minor shifting of contents. In other words, the shipper must (i) determine and document compliance with a limit of 160 mrem/hour (80% of the 200 mrem/hour limit) at the surface of the package, (ii) determine and document compliance with the 8 mrem/hour limit (80% of the 10 mrem/hour limit) at any point at 2 meters from the vertical planes projected by the outer edges of the vehicle, and (iii) perform a gamma dose rate survey by scanning the normally occupied space and determine compliance with the 1.6 mrem/hour limit (80% of the 2mrem/hour limit) and ensure that the personnel in this occupied space wear radiation dosimetry devices.

As such, due to the remaining concerns explained above, this approval of the Rancho Seco shipments shall not constitute an endorsement for using a similar approach for future amendment requests or applications.

CONDITIONS

The staff followed the guidance of NUREG-1609, "Standard Review Plan for Transportation Packages for Radioactive Material" during its review. Based on its review of the statements and representations provided in the application, the staff has reasonable assurance that the shielding design of the Model No. RT-100 package, with the proposed contents, meets the regulatory requirements of 10 CFR 71.47 and 71.51 with the following conditions:

- Contents shall be limited to activated steel and limited to Core Barrel Sections, Thermal Shield Sections, Upper Grid Segments, top sections of the Lower Internals, and chips

generated by the cutting process.

- Prior to shipment, package dose rates shall be measured to ensure compliance with 10 CFR 71.47.
- The measurement procedures and locations shall be commensurate with the standard of ANSI N14.36 "Measurement of Radiation Level and Surface Contamination for Packages and Conveyances".
- A 20% safety margin shall be applied for all dose rate measurements to address measurement uncertainties, loose contamination, and minor shifting of contents during transport.

CONCLUSIONS

Based on the statements and representations in the application dated June 3, 2014, as supplemented August 26, 2014, the staff agrees that the use by Robatel Technologies of the Model No. RT-100 package meets the requirements of 10 CFR Part 71, subject to the conditions listed above.

Issued on September 10, 2014.