July 16, 2012

MEMORANDUM TO: Doug Weaver, Deputy Director
Division of Spent Fuel Storage and Transportation, NMSS

FROM: Pierre Saverot, Project Manager **/RA/**
Licensing Branch
Division of Spent Fuel Storage and Transportation, NMSS

SUBJECT: SUMMARY OF JUNE 26-27, 2012, MEETING WITH ROBATEL TECHNOLOGIES, LLC

Background

Robatel Technologies, LLC (Robatel) will soon be submitting an application for a new package design, the Model No. RT-100 package. This meeting, the fourth in a series of pre-application meetings that began in November 2011, was devoted to the structural, thermal, containment, and shielding approaches for this package. The last pre-application meeting is planned in the August/September timeframe, i.e., a few weeks prior to submittal of an application.

Discussion

Robatel explained the design of the Model No. RT-100 package for which contents are limited, for the time being, to spent resins, filters, or a mix of both, with a 200 Watt limit even though most contents will have an actual heat load of 50 Watts or less.

Regarding contents, staff said that (i) the applicant shall be specific on the definition of the contents because 3,000 A_2 is a source of confusion, (ii) pre-shipment measurements cannot be used for the shielding evaluation of the package, and (iii) the design shall include shoring devices to prevent shifting of contents for smaller containers. Staff also suggested that the applicant reviews ISG-20, "Transportation Package Design Changes Authorized Under 10 CFR Part 71 Without Prior NRC Approval."

Regarding the impact limiter's benchmarking, staff believes that the preliminary results for the side drop and end drop cases appear to be appropriate in view of the proposed approach. However, the applicant needs to provide a good description of the methodology used for the modeling of the Sandia test for the NuPac 125B package, and the ANSYS model should include all the information listed in ISG-21, "Use of Computational Modeling Software." Staff noted that a 3/10 scale model confirmatory testing program will soon be performed to confirm the impact limiter performance for a side drop, an end drop and a Center of Gravity (CG)-over-corner drop. Staff reminded the applicant that (i) material property data should confirm assumptions such as isotropy, and (ii) the worst case should be assumed for static/dynamic conditions, hot/cold temperatures and foam density variability in order to ensure the bounding of actual conditions.

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Staff also reminded the applicant that (i) the package total deformation should be evaluated, (ii) the application should include all strain stress curves, (iii) structural drop analyses should consider bounding cases for the distribution of the content's mass in the package volume, taking into account how the loadings change according to such variability, (iv) concerns from a CG-over- corner drop are related to the lid and the impact on the lid bolts. Robatel responded that it will be possible to estimate on the scale model both the penetration through the foam and the damage to the bolts.

Regarding the pin puncture drop, staff stated that the basis presented for the selection of the most damaging orientation for the puncture test did not appear to be sufficient. Prying forces from a pin puncture drop may impact the containment of the package; therefore, the puncture drop should consider an impact through the hollow portion of the impact limiter and onto the lid, for possible effects on both the containment boundary (lid, lid bolts, etc.) and the thermal analyses. Staff reminded the applicant that the entire sequence of events, i.e., drop, pin puncture, followed by fire, has to be evaluated, and that the potential effect of a pin puncture on (i) the lid, (ii) the cover plate or (iii) the body of the package shall also be analyzed in the thermal chapter, along with any effect on the lead.

Regarding the tie-down configuration, chains are not a structural part of the package. It appeared to staff that the proposed approach to the tie-down requirement of 71.45(b)(3): "*Each tie-down device that is a structural part of a package must be designed so that failure of the device under excessive load would not impair the ability of the package to meet other requirements of this part*" might not be appropriate. The applicant is encouraged to provide references from other licensed packages for which an identical or similar approach might have been used or previously accepted by staff. On the other hand, analyses demonstrating that a tie-down failure does not affect the package performance appear to be appropriate. Robatel indicated that the tie-down arms and plates are not yet included in the model. Staff reminded Robatel of the 10 CFR 71.45(b)(1) requirement on the analysis of a static force, acting at the center of gravity of the package, with components of 2g vertical, 10g in direction of travel, and 5g transverse be analyzed: the analysis shall be provided for the combined system of forces such that maximum reactions at each support are achieved, i.e., loads are not to be applied as three separate conditions.

Staff told Robatel to provide a clear definition of the "lid to seal" contacts in order to evaluate whether the model is adequate, e.g., a seal may not decompress past its sealing effectiveness and an artificial behavior may not be imposed on a lid/seal boundary by a misapplication of contact surfaces. Staff also said that conditions were imposed in the certificate of compliance for the Model No. 3-60B package regarding the distribution of the weight of the contents, i.e., "contents shall be placed such that the CG of the package is at approximately the same location as the geometric center of the package – approximately the same location being defined as having a ±10% difference in distance of the cavity inside dimensions from the geometric center of the package in any direction."

Regarding the thermal evaluation of the package, staff said that 10 CFR 71.73 requires that an average fire emissivity of at least 0.9, with an average flame temperature of at least 800^{o}C, and a package surface absorptivity of at least 0.8, be used in the calculation when the package is fully exposed to the 30 minute fire. Staff also indicated that the write-up of the summary of the March pre-application meeting is correct. With only one emissivity allowed in an ANSYS code, the applicant should use 0.9 as required by staff from all applicants. This would not be the case

if the applicant was using other computer codes, like FLUENT and HEATING 7, which allow for more than one emissivity input.

A full thermal calculation package shall include data, tables, and plots of HAC fire, including maximum material/component temperatures, maximum temperature difference through-wall results, nodal temperature distributions, and temperature transients of fire shield, O-ring, lead gamma shield, cavity bulk air, and inner/outer steel shells. Staff also said that the thermal evaluation should show the temperatures where there is no ceramic paper insulation, i.e., near the lifting arms, etc. Staff indicated that the applicant shall justify the thickness of ceramic paper insulation around the package and the reasons for using such a material by providing technical data on its performance and previous uses when exposed to fire, because no current plans exist for performing an actual fire test. Staff said that the applicant shall analyze the puncture analysis at the package's side and at the package's top, along with a resulting HAC fire. The applicant should also take into account the convection effects of the fire on the surface of the package, i.e., include more than the radiation effects. Staff warned the applicant on any localized lead melting and that melting is a concern for staff (NUREG-1609 states the following: "Confirm that lead shielding does not reach melting temperature"). Even though melted lead is still contained in the package, the lead may shrink in volume during a post-fire cooling and leave an "empty" space at top of the package; thus, the shielding function may be lost. Staff advised Robatel to either have a completely defensible position on lead melting or implement package design changes to reduce lead temperature below the melting point.

Regarding containment, staff indicated that (i) all containment components, including upper flange and joining containment welds, should be mentioned in both the application and the licensing drawings; (ii) the test methods, test containment components, and test procedures should be described in detail in Chapter 8 of the application for fabrication, maintenance/periodic, and pre-shipment leak tests; (iii) the conditions for replacement of the containment O-rings, and its frequency, should be described; (iv) the description of the containment O-ring seals (EPDM) used at the primary and secondary lids, and at the vent port, should be provided; (v) leakage rate calculations for NCT and HAC limits (10 CFR 71.51) should be included in the containment chapter of the application; (vi) design pressure, maximum normal operating pressure (MNOP), and test pressure, should be also provided; (vii) calculations of MNOP/design pressure by considering temperature effect, gases released from payloads and/or package components, and any potential sources should be provided; and (vii) the cover plates (over the quick- disconnect valves) should be both described in the application and marked on the drawings. Staff also noted that, if the puncture test is not performed "... in a position for which maximum damage is expected [10 CFR 71.73(c)(3)]" to show that the quick disconnect valves can survive a direct hit, it will be difficult for Robatel to provide reasonable assurance that the containment boundary is not compromised. Staff said that it needs specific evidence that the time/temperature exposures of the seal are bounded by available performance data, either from the manufacturer or testing of other seals that can be shown to be equivalent to those used in the package. Staff reminded Robatel to verify compliance with NUREG-1609, ANSI N14.5, and NUREG/CR-6487.

Regarding shielding, the methodology used by the applicant appears to be reasonable. Staff noted that (i) the shielding analysis should translate into clear package operating instructions in Chapter 7 of the application for the user to determine the acceptability of the contents/materials to be shipped, (ii) the applicant should address loose contamination, which can concentrate

during NCT and HAC conditions, and (iii) all appropriate beta-emitters should be considered, accounting for decay chains (e.g., 144Ce – 144Pr, praseodymium).

Staff also indicated that it will be useful to include in the application some practical examples of shipments to demonstrate conservatism, and that it should be clear in Chapter 7 if the determination of the specific activity Ci/g is made by averaging or by finding the maximum density. Staff said that the applicant (i) should explain the rationale for using distributed sources, (ii) evaluate the case of a liner filled both with metal filters and resins, (iii) evaluate shifting under NCT, (iv) perform a shielding calculation when the cavity is full, and (v) evaluate instances of shipment of smaller volume sources where the specific activity Ci/g limit varies depending on the source volume.

Robatel told staff that they are considering coming back for a final pre-application meeting before submittal of an application in the Fall of 2012. Staff made no regulatory commitments during the meeting.

Docket No. 71-9365
TAC No. L24587

Enclosure 1: Meeting Attendees
Enclosure 2: Robatel Presentation – publicly available
Enclosure 3: Robatel proprietary slides.

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Distribution: Attendees, M. Waters, V. Cusamano, M. Rahimi, D. Pstrak,

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Meeting Between ROBATEL and the
Nuclear Regulatory Commission
June 26-27, 2012
Meeting Attendees

NRC/NMSS/SFST

Craig Hrabal	301-492-3257	craig.hrabal@nrc.gov
Michel Call	301-492-3289	michel.call@nrc.gov
Zhian Li	301-492-3235	zhian.li@nrc.gov
Joe Borowsky	301-492-3263	joseph.borowsky@nrc.gov
Pierre Saverot	301-492-3408	pierre.saverot@nrc.gov
Neil Day	301-492-3335	neil.day@nrc.gov
Jimmy Chang	301-492-3272	jimmy.chang@nrc.gov

ROBATEL

Fabien Labergri	33-4-72221026	f.labergri@robatel.fr
Christopher Dane	33-4-72221007	c.dane@robatel.fr
Curt Lindner	770-497-8818	clindner@enercon.com
George Jobson	540-230-6208	gjobson@robateltech.com
Teo Grochowski	540-989-2878	tgrochowski@robateltech.com
Gregoire Isaac	33-6-26581280	gisaac@robateltech.com
Dominique Sanchette	33-4-72221010	d.sanchette@robatel.fr

ENERCON

John Staples	770-792-6942	jstaples@enercon.com
Dominic Napolitano	700-497-8818	dnapolitano@enercon.com

WCS

Rod Baltzer	972-450-4235	rbaltzer@valhi.net