UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

September 14, 2015

Mr. Paul Triska
Vice President, Technical Services
AREVA Inc.
7135 Minstrel Way, Ste. 300
Columbia, MD 21045

SUBJECT: RENEWAL AND AMENDMENT APPLICATION FOR MODEL NO. TN-RAM – REQUEST FOR ADDITIONAL INFORMATION

Dear Mr. Triska:

By letter dated March 9, 2015, as supplemented May 21, 2015, you submitted an application for renewal and amendment of Certificate of Compliance No. 9233 for the Model No. TN-RAM package.

In connection with the staff's review of your application, we need the information identified in the enclosure to this letter. We request that you provide this information by October 9, 2015.

Please reference Docket No. 71-9233 and TAC Nos. L25001 and L25002 in future correspondence related to this request. The staff is available to meet with you to discuss your proposed responses. If you have any questions regarding this matter, please contact me at (301) 415–5790.

Sincerely,

/RA/

John Vera, Project Manager
Spent Fuel Licensing Branch
Division of Spent Fuel Management
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9233
TAC Nos. L25001 and L25002

Enclosure: Request for Additional Information

Mr. Paul Triska
Vice President, Technical Services
AREVA Inc.
7135 Minstrel Way, Ste. 300
Columbia, MD 21045

SUBJECT: RENEWAL AND AMENDMENT APPLICATION FOR MODEL NO. TN-RAM – REQUEST FOR ADDITIONAL INFORMATION

Dear Mr. Triska:

By letter dated March 9, 2015, as supplemented May 21, 2015, you submitted an application for renewal and amendment of Certificate of Compliance No. 9233 for the Model No. TN-RAM package.

In connection with the staff's review of your application, we need the information identified in the enclosure to this letter. We request that you provide this information by October 2, 2015.

Please reference Docket No. 71-9233 and TAC Nos. L25001 and L25002 in future correspondence related to this request. The staff is available to meet with you to discuss your proposed responses. If you have any questions regarding this matter, please contact me at (301) 415–5790.

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TAC Nos. L25001 and L25002

Enclosure: Request for Additional Information
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OFC	SFM	SFM	SFM	SFM
NAME	JVera	WWheatley for MDeBose	JSolis	VWilson
DATE	9/ 1 /2015	9/ 4 /2015	9/ 2 /2015	9/ 3 /2015
OFC	SFM	SFM	SFM	
NAME	CAraguas	MRahimi	BHWhite for MSampson	
DATE	9/ 3 /2015	9/ 8 /2015	9/14/2015	

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Request for Additional Information
AREVA Inc.
Docket No. 71-9233
Certificate of Compliance No. 9233
Model No. TN-RAM Package

By application dated March 9, 2015, as supplemented May 21, 2015, AREVA Inc., requested approval of an amendment for Certificate of Compliance No. 9233 for the Model No. TN-RAM package. This request for additional information identifies information needed by the U.S. Nuclear Regulatory Commission (NRC) staff in connection with its review of the application. 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 Materials," was used by the staff in its review of the application.

Each question describes information needed by the NRC staff for it to complete its review of the application and to determine whether the applicant has demonstrated compliance with regulatory requirements.

3.0 Thermal Evaluation

3-1 Explain how an emissivity value of 0.85 for weathered stainless steel surface is obtained and used in the thermal analysis of the TN-RAM package. Provide details of measurements and/or references to justify this value.

Page 3.5 of the safety analysis report (SAR) states that the external surfaces of the TN-RAM are assumed to have an emissivity of 0.85, a typical value for weathered stainless steel surfaces. However, the application does not provide any details on how this value is obtained (i.e. via measurement, approved code or standard, etc.)

This information is needed to determine compliance with Title 10 of the *Code of Federal Regulations* (10 CFR) 71.71 and 71.73

3-2 Clarify how assuming only radiation and gaseous conduction heat transfer in the thermal-shield air gap will result in bounding maximum temperatures for both normal conditions of transport (NCT) and hypothetical accident conditions (HAC).

Page 3.8 of the SAR states that heat transfer across a 0.125 in air gap in the thermal shield is modeled as a combination of radiation and gaseous conduction. This approach may result in non-conservative temperatures during HAC because it neglects convection through the air gap.

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

3-3 Provide the maximum thermal stresses calculated as a result of the heat load increase for both NCT and HAC.

SAR Chapter 3 states that the heat load was increased to 500 watts but it does not appear the maximum stresses have been recalculated as a result of the temperature increase of the package.

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

5.0 Shielding Evaluation

5-1 Discuss if there will be concentration of sources.

All of the shielding analyses performed for the TN-RAM assume that the source is uniformly distributed throughout the content. This assumption becomes non-conservative if a single part of the content is more highly activated than another. The staff notes that in response to request for supplemental information 5-1, the applicant stated that it included a specific activity limit in Section 1.2.3 of 10 Ci/kg. In its response it states: *"The purpose of this limit is to quantify the self-shielding credit taken in the analysis for normal conditions of transport (NCT). During loading, operators would calculate the total activity of the contents divided by the total mass of the contents."* Although this limit would ensure a certain amount of material to be present per activity, it does not control how the activity would be distributed throughout that content and would not prohibit highly concentrated source material within the presence of other low activity material.

Per the current shielding analyses the staff will have to prohibit the TN-RAM from transporting concentrated source material and put a condition that contents activity shall be uniformly distributed.

If these requirements are too restrictive to meet the transportation needs for the TN-RAM, the applicant should provide additional information/analyses on how activity distribution is controlled. They should include and justify the limits on distribution of the activity and/or include operating procedures within Chapter 7 of the SAR that ensure that highly activated material cannot be concentrated within a single location within the package.

This information is needed to determine compliance with 10 CFR 71.47 and 10 CFR 71.51(a)(2).

5-2 Specify which bulk materials other than stainless steel that can be shipped as a content in the TN-RAM and either justify that stainless steel is representative or bounding when considering self-shielding or provide analyses with the other self-shielding medium(s).

The current proposed certificate of compliance (CoC) does not include a description of what the contents are made of, only its radioactive properties. The discussion in Section 5.3.1 *"Configuration of Source and Shielding,"* of the SAR states that the four source configurations are all modeled with stainless steel. Since the shielding analyses only model stainless steel, based on this the staff must limit the TN-RAM CoC contents to activated steel. However per Section 1.2.3 of the SAR, some typical contents are made of Zirconium and would be excluded if the staff limited the contents to activated steel. The applicant should state all of the bulk materials that could be shipped (excluding materials in trace amounts) and discuss if modeling stainless steel self-shielding is either representative or bounding for all these materials or provide additional or updated

shielding analyses including consideration of the materials' self-shielding.

This information is needed to determine compliance with 10 CFR 71.47 and 10 CFR 71.51(a)(2).

5-3 Clarify the dimensions of the top (lid) and bottom of the TN-RAM package.

The drawings provided in the application are not clear. Staff reviews these drawings to determine whether models used to calculate external dose rates are consistent with actual package dimensions. Staff also performs independent evaluations using design information. The specific parts of the drawing that need clarification are the shielding components at the top and bottom of the package found in Drawing No. 990-702 "TN-RAM Packaging Shell Assembly."

a) The applicant should clarify the overall length of the TN-RAM cask with and without impact limiters. These numbers are not clear from the drawing.

b) The applicant should clarify the length of the lead shielding and its position within the overall cask length, i.e. how much additional steel/lead is above and below the shield. This value is shown but is not clear, and it appears there is additional lead represented by the "X" shaped markings that are outside this line.

c) The applicant should clarify the size (height and radius) of the top (lid) and bottom lead shields. The applicant should include dimensions for the optional lid as well.

d) The applicant should clarify the thickness of stainless steel in the axial direction above and below each of the lead shields in the top and bottom of the cask. The applicant should include thickness of stainless steel in the lid and optional lid.

This information is needed to determine compliance with 10 CFR 71.33, 10 CFR 71.47 and 71.51(a)(2).

5-4 Justify the following configurations chosen for the evaluation for the "normally occupied space."

The 5 meter dose rate represents the "normally occupied space" per 10 CFR 71.47(b)(4). The applicant should justify this evaluation is appropriate by addressing the following:

a) Footnote 1 to Table 5-12 of the SAR states: *"These tallies are averaged over a large surface to show that an operator in the vicinity of the package will experience less than 2 mrem/h."* The applicant should explain what is meant by "large surface" and justify that this is appropriate.

b) For a horizontally oriented cask the "top" and "bottom" dose rates are evaluated. The staff does not understand why the top disk source is not limiting for this evaluation. The applicant should discuss any factors that would cause the homogenized cylinder to produce higher dose rates for this evaluation.

c) The operating procedures discuss vertical shipment of this cask. The applicant should evaluate the dose rate for the "normally occupied space" when the cask is oriented vertically and they also need to justify the choice of the source modeling configuration (top disk, homogenized, etc.).

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

5-5 Justify the results in Table 5-12 of the SAR.

a. Staff is not clear on how the homogenized cylinder shows higher radial dose rates than the annulus, since the applicant is evaluating dose rate by averaging tallies around the entire radius. Section 5.4.4 of the SAR states: *"There is no angular segmentation for any tally."*

b. The staff expects that the disk at the bottom to produce the highest dose rates calculated at the bottom of the package in all cases, however, Table 5-12 of the SAR shows that the homogenized cylinder gives a higher dose rate at 2 meters. The applicant should justify why the homogenized cylinder shows higher dose rates at the bottom than the bottom disk.

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

5-6 Justify the source geometry for the HAC shielding evaluation.

Section 5.3.1 states: *"For the HAC evaluation, the source was placed inside the package using the homogenized source dimensions and location."* Although the staff is aware that there is no self-shielding evaluated during HAC, as discussed in Section 5.3.1 of the SAR, the applicant should justify that this conservatism is enough to compensate for any source concentration that may occur during HAC. Other packages that show large margins to HAC dose rate limits do not credit source distribution (i.e. they use a point or line source as appropriate).

This information is needed to determine compliance with 10 CFR 71.51(a)(2).

5-7 Justify the size of the segments for the mesh tallies (detectors) used to evaluate the dose rates and justify that streaming was adequately accounted for under NCT and HAC.

Section 5.4.4 states: "*Radial tallies are segmented axially between 20 and 22 cm. Axial tallies are segmented radially approximately 22 cm."* The applicant should justify that these segments are small enough to evaluate the effects of streaming. The staff is interested in the area in the axial and radial directions between the lead shielding in the cask body and the lid. The area above the lead shielding is of specific importance during HAC shielding evaluation where there is lead slump. In discussing streaming effects, the applicant should justify that the source configuration selected for this evaluation gives the highest dose rate (i.e. a more concentrated source, like the disk source at the top would exaggerate the effects of streaming more than the homogenous

source, etc.).

This information is needed to determine compliance with 10 CFR 71.47 and 10 CFR 71.51(a)(2).

5-8 Discuss the use of variance reduction and how this was used in conjunction with the mesh tally and that all locations around the cask (including areas around streaming paths) were appropriately considered in the biasing.

Section 5.4.1 of the SAR states: *"Simple Russian roulette is used as a variance reduction technique for most tallies. The importance of the particles increases as the particles traverse the shielding materials."* The applicant should discuss how the importances were developed for each of the various tally locations (axial, radial, streaming paths, etc.) and justify that the variance reduction does not create any non-physical results.

This information is needed to determine compliance with 10 CFR 71.47 and 10 CFR 71.51(a)(2).

5-9 Clarify the source configurations described in Table 5-12 of the SAR.

In addition to the four source configurations described in Section 5.3.1 of the SAR, dose rate results for a 5th source configuration are listed in Table 5-12 SAR. The configuration that is not described in Section 5.3.1 of the SAR is "cylinder." The applicant should provide details on what this configuration is.

This information is needed to determine compliance with 10 CFR 71.33, 10 CFR 71.47 and 71.51(a)(2).

5-10 Update HAC shielding evaluations to account for deformation of the impact limiter due to the tests in 10 CFR 71.73.

Section 5.3.1 of the SAR states*: "The impact limiters are removed and replaced with air even as they are shown to remain attached under all postulated tests as described in Section 2.7.6."* Locations for the dose rate tallies under HAC are all in relation to nominal (non-deformed) impact limiter dimensions. Section 3.5.1 of the SAR states that there would be a deformation from the 30 foot drop with a crush depth of 12.48 inches on the side and 9.05 inches in the axial direction. There would be additional deformation of the impact limiter as a result of charring from the fire and even though the stainless steel shell would still be present, the applicant would need to further demonstrate that the shell alone could support the weight of the package given the loss of material consumed by the fire. The applicant should update the HAC shielding evaluations to account for the deformation of the impact limiter from drop tests and fire. The applicant should justify that the amount of deformation is appropriate to account for these tests.

This information is needed to determine compliance with 10 CFR 71.51(a)(2).

5-11 Clarify the contents of the package.

The draft CoC includes "2,727 A_2" as an allowable content. A limit of "2,727 A_2" is ambiguous. The gamma source term in the shielding evaluation is based on 30,000 Ci Co-60 with equivalence to other gamma emitting nuclides, as discussed in Section 5.5.3 of the SAR. However, there are no analyses for alpha, beta or neutron sources. Since alpha and beta radiations are typically not challenging to the shielding employed in this package, the staff can only assume that 2,727 A_2 was meant for these radiation sources only.

Based on the shielding analyses as provided, the staff can only approve the following authorized contents in the CoC: 2,727 A_2 for alpha and beta sources only (assuming the additional information requested in RAI 5-13 is provided), with gamma sources limited to 30,000 Ci Co-60 or equivalent.

The applicant should clarify the limit of 2,727 A_2 from the draft CoC, and provide additional analyses justifying the shipment of up to 2,727 A_2 of gamma and neutron sources, if this is what this limit was intended for.

This information is needed to determine compliance with 10 CFR 71.47 and 10 CFR 71.51(a)(2).

5-12 Discuss the potential for neutron sources or justify why an evaluation is not needed.

Section 5.2.2 of the SAR states: *"No neutron generating source material beyond an inconsequential amount as a result of surface contamination is to be transported. Therefore, no neutron source is evaluated."* Although insignificant, the currently proposed contents descriptions in Section 1.2.3 of the SAR include neutron sources. Some nuclides are gamma and neutron emitters. Since it would be impractical to include a limit of zero neutron sources within the CoC, a small quantitative limit must be included for neutron emitting sources as well as an analyses that justifies the limit. Examples of language used to establish neutron source limits used in other CoC's shipping similar contents are provided below:

"A maximum total package neutron source of $1x10^5$ neutrons/second for materials that produce neutrons (other than fissile materials) through any means, including spontaneous fission, alpha-neutron reactions, and gamma-neutron reactions."

"A maximum total package neutron source of 3.5 10^{-6} Ci/g for materials that produce neutrons (other than fissile materials) through any means, including spontaneous fission, alpha-neutron reactions, and gamma-neutron reactions."

Alternatively, an appropriate evaluation or justification (with quantitative as well as qualitative support) for not needing an evaluation should be provided. Any evaluation or justification should address important factors such as the radionuclides that may be present, distribution of the radionuclides and contents compositions. Alpha-n reactions in the contents should also be addressed.

This information is needed to determine compliance with 10 CFR 71.47 and 10 CFR 71.51(a)(2).

5-13 Justify, with an evaluation, that 2,727 A_2 is an acceptable content quantity limit for beta-emitting nuclides addressing the potential for significant generation of Bremsstrahlung.

For at least some beta-emitting nuclides, Bremsstrahlung may be significant as a source of radiation exposure from the package. This concern is particularly for those nuclides that emit high energy betas and the proposed content quantity limit allows for significant quantities of those nuclides to be transported. An example is P-32 with a maximum beta energy of 1.71 MeV (the average is 695 keV), emitted with each decay, and an A_2 value comparable to that of Co-60 (14 curies vs. 11 curies). A quantitative, as well as qualitative, justification is needed.

This information is needed to determine compliance with 10 CFR 71.47 and 10 CFR 71.51(a)(2).