September 6, 2007

Mr. Richard D. Montgomery
Advisory Engineer
AREVA NP, Inc.
P.O. Box 10935
Lynchburg, VA 24506-0935

SUBJECT: REQUEST FOR ADDITIONAL INFORMATION FOR REVIEW OF THE MODEL NO. MAP-12 AND MAP-13 PACKAGES

Dear Mr. Montgomery:

By letter dated March 13, 2007, AREVA NP, Inc. (AREVA) submitted an application requesting a Certificate of Compliance (CoC) for the Model No. MAP-12/ MAP-13 packages.

In connection with the staff's review, we need the information identified in the enclosure to this letter. We request that you provide this information by November 6, 2007. Inform us at your earliest convenience, but no later than October 23, 2007, if you are not able to provide the information by that date. To assist us in re-scheduling your review, you should include a new proposed submittal date and the reasons for the delay.

Please reference Docket No. 71-9319 and TAC No. L24069 in future correspondence related to this request. The staff is available to meet to discuss your proposed responses. If you have any questions regarding this matter, I may be contacted at (301) 492-3285.

Sincerely,

/RA/

Jessica Glenny, Project Scientist
Licensing Branch
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

Docket No. 71-9319
TAC No. L24069

Enclosure: Request for Additional Information

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Request for Additional Information
AREVA NP, Inc.
Docket No. 71-9319
Certificate of Compliance No. 9319
Model No. MAP-12 and MAP-13 Packages

By application dated March 13, 2007, AREVA NP, Inc. (AREVA), requested a Certificate of Compliance for the Model No. MAP-12/MAP-13 packages. This request for additional information (RAI) identifies information needed by the U.S. Nuclear Regulatory Commission staff (the staff) in connection with its review of the safety analysis report (SAR). The requested information is listed by chapter number and title in the SAR. NUREG-1609, “Standard Review Plan for Transportation Packages for Radioactive Material,” was used for this review.

Chapter 1.0 General Information

1-1 Clarify the discrepancy between the cover letter and Section 1.2.2.2, page 1-10, of the SAR regarding the justification for a “Type B” classification of the MAP-12/MAP-13 packages.

The cover letter of the application states: “Since this material constitutes Type B material due to the U-236 content, the shipment and use of this fuel is directly dependant upon the implementation of the MAP shipping package …[.]” Section 1.2.2.2 of the SAR states: “The increase in ^{234}U causes the contents to fall under the Type B requirements.” It is not clear as to the reason AREVA is requesting a “Type B” classification for the Model No. MAP-12/MAP-13.

This information is needed to determine compliance with 10 CFR 71.33.

1-2 Confirm that AREVA is not seeking approval for the transportation of loose fuel rods per the current version of the application.

Section 1.1, Page 1-1, of the SAR states: “The MAP package is designed to transport both Type A and Type B fissile material in the form of unirradiated nuclear fuel assemblies or loose rods containing sintered uranium dioxide fuel pellets enriched up to 5.0 weight percent ^{235}U.” Chapter 6 of the SAR, however, does not provide a criticality evaluation for the loose fuel rod contents in the MAP-12/MAP-13 packages.

This information is needed to determine compliance with 10 CFR 71.35.

1-3 Explain how the CSI value of 2.8 was obtained. Also explain the application of the CSI value to the loose fuel rod contents in the MAP package.

Section 1.1, page 1-1, of the application states the MAP’s CSI is 2.8 for fuel assemblies and loose fuel rods; however there is no criticality evaluation provided in the SAR for the loose fuel rods in the MAP package.

This information is needed to determine compliance with 10 CFR 71.35.

Chapter 2.0 Structural Evaluation

2-1 Provide the discussion and/or analysis to demonstrate the structural integrity of the cladding during hypothetical accident conditions (HAC).

The fuel rod cladding is considered to provide containment of radioactive material under both normal conditions of transport (NCT) and HAC. Section 2.11 states that the discussion of cladding and its ability to maintain sufficient mechanical integrity to provide such containment is described in Section 1.2.2 and Chapter 4.0 of the SAR. No such discussions were found to verify the structural integrity of the cladding during HAC.

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

Chapter 3.0 Thermal Evaluation

3-1 Revise the following pages to incorporate omitted references: 3-16, 3-25, 3-46, 3-47, 3-48.

The sources referenced in the above listed pages are omitted and instead show the following text: “Error! Reference source not found.” In some instance a figure number is referenced and the source can be identified within the application, in other instances there is no identifiable information with regards to the reference.

This information is needed to determine compliance with 10 CFR 71.7(a).

3-2 Provide a figure that reports steady-state temperatures for the MAP-12/MAP-13 packages under NCT hot conditions with insolation. Justify that the method used to apply solar insolation (assuming a diurnal cycle as opposed to a constant heat flux) provides a conservative result.

Figure 3-1 of the SAR shows the time evolution of NCT temperatures under hot conditions with solar insolation. It is not clear from the figure that the package reaches steady state temperatures for the time scale presented.

This information is needed to determine compliance with 10 CFR 71.35 (a).

3-3 Provide a description of how the solar absorptivity values listed in Table 3-6 of the SAR were actually applied to the thermal model.

Application of solar absorptivity values to the package surfaces can serve to decrease the amount of energy absorbed by a package, thereby, reducing the intended values for insolation as outlined in 10 CFR 71.71(c)(1).

This information is needed to determine compliance with 10 CFR 71.35(a).

3-4 Provide a clarification of the sequence of events related to the fire test of the MAP certified testing unit (CTU), with particular attention to when the test was concluded and what means were used to extinguish the pool fire.

It is not clear from the description provided in Section 3.4.2, page 3-22, of the SAR what the actual sequence of events was related to the end of the fire test of the MAP CTU. The regulation in 10 CFR 71.73 clearly prohibits the use of fire suppressants to stop any combustion that may occur on or in a package that is being tested following the conclusion of the fire test. The SAR states that a fire suppressant foam was used to attempt to suppress the fire, but it is not clear if this foam served to provide cooling to the CTU as well.

This information is needed to determine compliance with 10 CFR 71.35(a).

3-5 Justify the claim that the test fire generated twice the heat input to the package than the regulatory 800°C 30 minute fire.

Section 3.4.2, page 3-23, estimated the fire had twice the heat input of a regulatory fire due to the higher temperature and longer duration, as radiative heat transfer scales as absolute temperature to the fourth power. However, only the heat transfer due to radiation would be two times larger than a regulatory fire, not the total heat flux. Further justification of this statement is needed. If AREVA believes the fire test exceeded the regulatory requirements, then a clear, quantitative discussion of the conservatisms present in the fire test should be presented.

This information is needed to determine compliance with 10 CFR 71.35(a).

3-6 Provide a <u>detailed</u> description of the temperature sensitive strips used during thermal testing and a rationale for their use over other methods of measuring temperatures inside the package during the HAC fire test. Provide additional justification for the accuracy of predicted temperatures for components internal to the package.

Section 3.4.3.1, page 3-23, of the SAR states that temperatures inside the package were to be measured with temperature sensitive strips, which were unreadable due to condensation from foam out-gassing, causing the temperatures to be estimated from the extent of damage to each package component. Given this, temperature sensitive strips appear to be a less than ideal choice for this application. The temperatures reported in the SAR need to be more accurate in order to make a safety finding.

This information is needed to determine compliance with 10 CFR 71.35(a).

3-7 Provide a complete description of the physical state of the neutron moderator components after the HAC fire test. Include photographs of those components if available (reference Section 3.4.3.1 of the SAR).

One of the criteria by which the package design is to be evaluated is how the neutron moderator components survive the HAC fire test. Therefore, the staff requires all possible information relating to their condition after the fire.

This information is needed to determine compliance with 10 CFR 71.33.

3-8 Provide a detailed description of the behavior of the intumescent char layer of polyurethane foam described in Section 3.5.3 of the SAR, specifically with regards to its expansion, and the structural stresses it may incur in the package shell.

A property of intumescent polyurethane foam is expansion to seal any holes in the outer shell caused by puncture damage during the fire exposure. However, according to design drawings, it appears that in certain areas of the package, the foam has no room to expand. Depending on the amount of expansion the foam undergoes as it decomposes, it could cause additional structural stresses.

This information is needed to determine compliance with 10 CFR 71.33.

3-9 Provide a comparison of the NCT analysis conducted in SINDA/FLUINT and the observations of NCT (pre-fire) temperatures of the actual MAP CTU (reference Section 3.5.2.1 of the SAR).

Typically, when analytical (computer based) models are presented for a package design, there is some comparison made between the analysis model results and any experimental results, if physical testing was conducted, in order to validate the predications of the analytical model. The applicant has provided an analysis to predict NCT temperatures as well as test results for HAC. There is no nexus drawn between the analytical modeling and the experimental test results. Comparisons of this type serve to strengthen the demonstration of thermal performance of the package when they are presented.

This information is needed to determine compliance with 10 CFR 71.35(a).

3-10 Provide a summary in Section 3.5.3 of the SAR of the physical properties of charred/decomposed polyurethane foam (e.g., specific heat, thermal conductivity, density, etc.). If these properties are not available, provide a justification for the exclusion of these properties from the SAR. Include a discussion of the intumescence of the foam and what effects the foam material reaction could have on the other materials of the package.

Information about the decomposed foam is necessary for confirmatory analyses of the performance of the package in response to HAC conditions. References for this information should be cited in the SAR.

This information is needed to determine compliance with 10 CFR 71.33.

3-11 Provide the rationale for conducting the “bucket tests” (mentioned in Section 3.5.3) as a means to determine the correlation between foam recession depth and density. Discuss how the bucket tests influenced the testing and evaluation of the MAP 12/MAP-13 packages, and provide justification of the applicability of the bucket tests to the foam as it was used in the package.

The value of the bucket tests that were conducted on the foam is not clearly described in the SAR. Additionally, this relationship of foam density to recession rate only applies when the fire conditions (heat, duration, etc.) and material configuration (surface area,

depth, etc., of each material) are reasonably close to the bucket test, which may not be the case for the fire test. It appears that measuring the amount of decomposition (which could be easily correlated to the recession depth) as a function of heat input, or temperature, could provide more useful information. This could be used to estimate the heat input or highest temperatures seen during the fire test by examining the recession depth of the charred foam.

This information is needed to determine compliance with 10 CFR 71.71(c)(1) and 71.73(c)(4).

Chapter 4.0 Containment

4-1 Correct the inconsistency for the cladding leakage rate mentioned in Section 4.2.3, page 4-3, and in Section 8.1.4, page 8-2. Also specify the type of gas used for the leak test.

Section 4.2.3, says that “the containment boundary is less than 3E-08 ref-cc/sec.” Section 8.1.4 says, “the leak rate is typically less than 1E-7 atm-cm^3/sec.” The post fabrication leakage test for the fuel rods should be clearly and unambiguously stated in both sections.

This information is needed to determine compliance with 10 CFR 71.33.

4-2 Provide justification in the SAR that the cladding can withstand HAC in the form of drop test and fire test results, such that the containment boundary remains unbreached. Also, describe the condition of the cladding after being subjected to HAC.

Section 4.3.2.2 states: “The performance tests documented in Section 2 [of the SAR] demonstrates that no pellets are released from the cladding as a result of the postulated hypothetical accident conditions.” Contrary to this statement no material could be identified in the SAR that describes the condition of the cladding after being subjected to HAC.

This information is needed to determine compliance with 10 CFR 71.33.

4-3a) State in the SAR whether or not the dummy fuel assembly in the CTUs had the fuel tubes pressurized. Also, if the CTUs rods were not pressurized, explain what effect pressurized rods would have on cladding integrity resulting from HAC.

b) Explain how the CTUs with a dummy fuel assembly bound the case of shipment of loose rods in a container for the HAC tests. Also, evaluate any additional effect on the loose rod cladding integrity resulting from the HAC tests.

The staff needs this information to ascertain whether or not the dummy fuel assembly adequately represents the fuel being shipped in the drop tests. For example, the drop tests only include a dummy assembly which would tend to reduce bending forces on an individual rod by reinforcing it with the combined strength of the assembly.

4-4 Include in the SAR the weight of fuel that is equivalent to an A_2 quantity and the likelihood of it escaping from the post-HAC of the cladding.

This information is needed to clarify exactly how much fuel could be released after a postulated accident and still be below an A_2 value.

This information is needed to determine compliance with 10 CFR 71.33.

4-5 State the initial pressure in the fuel rods in the SAR. It is suggested to include this as an addition to Table 1-1 or 1-3.

This information is needed to provide an accurate description of the fuel being shipped and it provides a mechanism for propelling particulates from a failed fuel rod, or in this application, the containment boundary.

This information is needed to determine compliance with 10 CFR 71.33.

Chapter 6.0 Criticality

6-1 Justify the statement: “any form of borated aluminum that satisfies the ^{10}B areal density requirement is acceptable,” in Section 6.2.1.3.2.1, page 6-8, of the SAR.

It has been NRC practice for approved containers to permit only absorber materials that have been properly qualified, have sufficient durability for the application, and require acceptance standards on fabricated neutron absorber plates to be used in casks licensed under 10 CFR Part 71. Qualification and acceptance tests of the material are comparatively few when only 75% credit for ^{10}B is to be taken but “any material that contains a boron absorber” would not be suitable.

This information is needed to determine compliance with 10 CFR 71.33.

6-2 Justify the nomenclature “borated aluminum” as used to represent the commercial product BORAL®.

Traditionally, the term “borated aluminum” has been used to represent a solid solution containing boron. It has not been used to represent a composite of powders that are formed into an absorber material. The description given for BORAL® is the type expected for a composite material.

This information is needed to determine compliance with 10 CFR 71.33.

6-3 Justify the use of 90% credit given to the moderator block, and 100% theoretical density for the moderator nylon materials.

Section 6.4.5.1.3, states, “The moderator blocks for the flux trap system are modeled with a uniform dimensional reduction that results in 90% of the total moderator block volume for the flux trap being modeled.” The staff is not familiar with the nylon in question. For example, helpful information would be the data source and how manufacturing tolerances and other variables would be expected to influence pertinent properties of moderator materials.

This information is needed to determine compliance with 10 CFR 71.33.

6-4a) Explain the basis of the criticality safety evaluation under the assumptions that 1) it was based on moderator exclusion; and 2) that the fuel cladding gap was not floodable.

b) Justify the ability of the fuel cladding to retain its integrity after the HAC tests so as to achieve moderator exclusion.

Section 6.2.1.1, page 6-5, of the SAR states that the containment system of the MAP packages consists of the fuel rod cladding. Section 6.4.2.1.1, page 6-16, of the SAR states: “The fuel-clad gap is modeled as void to represent a dry gap. The fuel-clad gap within the fuel rods in the fuel assembly is not considered as floodable based upon the HAC testing results, discussed in Section 6.4.5.4.” This is not consistent with the requirements set forth in 10 CFR 71.55, which requires the package to be sub-critical even if water were to leak into the containment system.

This information is needed to determine compliance with 10 CFR 71.55.

6-5 Explain how the fuel-cladding gap can remain dry after the puncture and immersion test.

Section 6.4.5.4, page 6-29, of the SAR states that fuel rod cladding did not crack and rupture after testing under the HAC described in Section 2.12. The staff reviewed the HAC testing in Section 2.12 and found that the puncture was conducted on the packaging instead of the containment boundary, which is the cladding.

This information is needed to determine compliance with 10 CFR 71.73(a) and 71.73(c)(3).

6-6 Provide an explanation on the behavior of the k_{eff} curves as a function of the package array size, in Figure 6-29.

Figure 6-29 shows the change of k_{eff} as a function of package array size with the FLIP1 configuration. From this figure, it can be observed that the k_{eff} value increases first, and then goes down as the number of packages increases. Finally, the k_{eff} value jumps from 0.9356 to almost 0.9420. This curve does not seem to be consistent with common understanding of the physics of a fissile system.

This information is needed to determine compliance with 10 CFR 71.55.