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June 26, 2020
E-57013

U.S. Department of Transportation
Attn: Mr. Richard W. Boyle, Chief
Pipeline & Hazardous Materials Safety Administration
Radioactive Materials Branch
1200 New Jersey Avenue, S.E.
East Building, PHH-20
Washington, DC 20590

Subject: Supplemental Information for Application for Validation of French Competent Authority Certificate F/348/AF-96 for Model No. FCC-4 Transport Package

Reference: [1] NRC letter to U.S. DOT dated April 21, 2020, "Subject: Application for the Model No. FCC-4 Transport Package – Supplemental Information Needed"

[2] TN Americas LLC letter E-55607 dated December 12, 2019, "Subject: Application for Validation of French Competent Authority Certificate F/348/AF-96 for Model No. FCC-4 Transport Package"

[3] TNI letter COR-20-031142-000 version 2.0 dated June 9, 2020, "Subject: Request for Supplemental Information and Observations"

Dear Mr. Boyle:

TN Americas LLC, on behalf of TN International, submits the supplemental information requested by the NRC [1] to complete the review for acceptance of an application [2] for revalidation of French Competent Authority Certificate F/348/AF-96 for Model No. FCC-4, in accordance with §173.473.

Enclosure 1 provides supplemental information provided by TN International [4] that includes listing of drawing, standards and more generally all the written documents requested for the acceptance of the application. The TN Americas LLC affidavit provided with the original application [2] and an affidavit provided by Framatome with the supplemental information [3] provide the statements of proprietary information pursuant to 49 CFR 7.14, 49 CFR 105.30, and 10 CFR 2.390.

Enclosures transmitted herein contain SUNSI. When separated from enclosures, this transmittal document is decontrolled.

Enclosure 2 and 3 provide the drawings and standards listed in the supplemental information response [3]. The English version of the French Standard documents is intended for the exclusive and non-collective use by Orano for the U.S. Nuclear Regulatory commission (NRC) review of the application [2]. All network exploitation, reproduction and re-dissemination, even partial, whatever the form (hardcopy or other media), is strictly prohibited. TN Americas requests that access to French Standard documents be limited to only persons reviewing the application, and all copies deleted upon completion of the application review.

Should you have any questions or require additional information to support review of this application, please contact Peter Vescovi by telephone at 336-420-8325, or by e-mail at peter.vescovi@orano.group.

Sincerely,

Don Shaw
Licensing Manager
TN Americas LLC

cc: Michael Conroy, U.S. Department of Transportation
Don Shaw, TN Americas LLC
Laurence Labbe, TN Americas LLC
Brigitte Latour, TN International

Enclosure(s):

1. TNI letter COR-20-031142-000 (Non-proprietary)
2. RSI-MA-1.zip (Proprietary)
3. RSI-MA-2.zip (Proprietary)
4. Affidavit Pursuant to 10 CFR 2.390

Ref.: COR-20-031142-000 vers. 2.0

Montigny-le Bretonneux, Tuesday, June 9, 2020

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Subject: Request for Supplemental Information and Observations

U.S. Department of Transportation
Docket no. 71-3097 / EPID L-2020-NEW-0000

French Approval Certificate Number F/348/AF-96, Revision Fq
Model No. FCC-4 Package

References:

[1] Safety Analysis Report of Package Model FCC4 – TN International – DOS-19-021166-1.0
[2] French Approval certificate - French Approval Certificate Number F/348/AF-96, Revision Fq, Model No FCC-4 transport package
[3] Request for Supplemental Information and Observations U.S. Department of Transportation – French Approval Certificate Number F/348/AF-96, Revision Fq – Docket No. 71-3097 – Model No. FCC-4 Package

Enclosed documents:
See in the responses to the requests

Important note:
The Drawing, Standards and more generally all the written documents transmitted as well as all the attached documents and information shared are proprietary information and must not be made public or transmitted to a third party.
Additionally, regarding transmitted standards, only one copy is permitted for the U.S. Nuclear Regulatory Commission (NRC).

TN International
S.A au capital de 30 291 000 Euros
SIREN 602 039 299 - APE 7112B
N° Intracommunautaire :
FR 25 602 039 299

REQUEST FOR SUPPLEMENTAL INFORMATION

Materials Evaluation

RSI-Ma-1

Provide the English translation of all design-basis drawings, package-contents drawings, and any other packaging design information provided as part of the application. Ensure all drawings are legible and define pertinent welding requirements consistent with the application.

Drawings in Chapters 1.3 and 1.4 and Appendices 1.3, 1.4, and 2.1 of the application were provided in French. The drawings, as well as any other supporting design-basis information related to the application, should be translated to English and provided as part of the application to allow the staff to perform an adequate safety review. Further, drawings of the transport contents, as provided in Chapter 1.3 of the application, are not legible and are in French. Ensure that all drawings identify the weld requirements for the packaging consistent with the design assumptions in the safety analysis.
This information is necessary to ensure compliance with the requirements in Paragraphs 607 and 640 of the IAEA SSR-6, "Regulations for the Safe Transport of Radioactive Material," 2012 Edition.

Elements given, and information shared in this response are proprietary information.

See below, the answers given for each Chapter or Appendix concerned by the request:

- **Chapter 1.3 (Drawings)**

  Translation of the following drawings are available as an attachment:

  Figure 1.3-1 FUEL ASSEMBLY TYPE 17X17 - 1300 MWE
  Figure 1.3-2 FUEL ASSEMBLY TYPE 17X17 - 1450 MWE
  Figure 1.3-3 FUEL ASSEMBLY TYPE 16X16
  Figure 1.3-4 FUEL ASSEMBLY TYPE 18X18

- **Appendix 1.3-2 (Drawings)**

  Translation of the following drawings are available as an attachment.

  47-0-01-99-01-00 sheet 2/2 index I: FCC4 rod box – Assembly
  47-0-01-99-01-02 index J: Axial spacer
  47-0-01-99-01-06 index F: Support plate length 2460
  47-0-01-99-01-09 sheets 1 & 2 index G: Radial spacer length 2460
  47-0-01-99-01-16 index E: support plate – fixed end
  47-0-01-99-01-22 index A: Packing spacer – length 2460 – th. 5
  PLA-16-00179264-300-00: FCC4 EPR rod box - Assembly drawing
  PLA-16-00179264-201-00: Safety drawing of the axial spacer for EPR rod boxes
  PLA-16-00179264-202-00: Safety drawing of the fixed end support plates of the EPR rod boxes
  PLA-16-00179264-203-00: Safety drawing for compensation spacers – Th. 5, EPR rod boxes

- **Chapter 1.4**

  Figure 1.4-4: Illustration of the FCC4 packaging

  This figure is an extract from the drawing 229 K 0400 index G given in Appendix 1.4-1 of the FCC4 Package SAR.

  About the welds, the complete analysis is performed in Table 1.4-5 of Chapter 1.4 of the FCC4 Package SAR. This table regroups the welds important to the safety of the packaging and gives:
  - the identification of the weld,
  - the materials used,
  - the type of weld,
  - the control after manufacturing.

- **Appendices 1.4-1, 1.4-2, 1.4-3 (Drawings)**

  Each drawing is already provided with an English version: either in subtitles on the same sheet as the French version or on a separate sheet.

- **Appendix 2.1-2**

  Translation of the Chapter 2.1-2 is available as an attachment.

RSI-Ma-2

Provide the following references cited in the application. Ensure all documents are translated into English.

a. *From Appendix 1.3-1, DOS-13-00081778-031_01:*
   i. *Standard NF EN 10088-3*
   ii. *Standard NF EN 485-2*
b. *From Appendix 1.3-3, FFDC05098 EN:*
   i. *Standard NF EN 10045-1*
   ii. *Reference to "method developed by the CEA and AREVA NP and presented to the ASTM Conference at Annecy in June 2001."*
c. *From Chapter 1.4, DOS-1300081778-040_02:*
   i. *CODAP – 2005 – Section I, Appendix I1.A1 and I1.A2, including Tables I1.A1-1 and I1.A1.2 for Category A.*
   ii. *NF A 35-557 - Metallurgical Products – Special Steels suitable for thermal processing for high-performance external thread fixing components used in mechanical constructions.*
   iii. *NF EN 10113-1 - Hot-rolled weldable products in fine-grain structural steel. Part 1: General conditions for delivery (Classification index: A 36-201).*
   iv. *NF EN 10025 - Hot rolled products in non-alloy structural steels – Technical requirements for delivery (Classification index: A 35-501).*
   v. *NF EN 10088-3 - Stainless Steels - (Classification index: A 35-574), Section 3: Technical Conditions relating to the delivery of part-finished products, bars, machined wires and profiles for general purpose use.*
   vi. *NF EN 10028-3 - Flat steel products for pressure vessels.*
   vii. *NF A36-601 Forged steel components for boilers and pressure vessels. Carbon and carbon manganese steels.*

viii. *NF EN 10028-7 - Flat steel products for pressure vessels. Stainless steels.*

d. *From Appendix 1.4-3, FFDC01079EN:*
   i. *Standard 35501*
   ii. *Standard EN 10025*
   iii. *NF EN 10045-1*

e. *From Appendix 2.2-3, DOS-13-00081778-203_01:*
   i. *AREVA NP document FS1-0004231, Revision 1.0: Volume calculations for different fuel rod designs – Transport problem*
   ii. *AREVA NP internal document FD-16-00285, Revision 1.0: Answers to questions by the ASN on EDGAR tests and the Zircaloy-4 model.*

This information is necessary to ensure compliance with the requirements in Paragraphs 607 and 640 of the IAEA SSR-6, 2012 Edition.

Elements given, and information shared in this response are proprietary information. Additionally, regarding transmitted standards, only one copy is permitted for the U.S. Nuclear Regulatory Commission (NRC).

The references below are available as an attachment.

a. From Appendix 1.3-1, DOS-13-00081778-031_01:
   i. NF EN 10088-3.
   ii. NF EN 485-2+A1.

b. From Appendix 1.3-3, FFDC05098 EN:
   i. NF EN 10045-1 is cancelled and replaced by NF EN ISO 148-1.
   ii. Activated Slip Systems and Localized Straining of Irradiated Zr Alloys in Circumferential Loadings - C. Regnard, B. Verhaeghe, F. Lefebvre-Joud and C. Lemaignan

c. From Chapter 1.4, DOS-1300081778-040_02:
   i. CODAP – 2005 – Section I, Appendix I1.A1 and I1.A2, including Tables I1.A1-1 and I1.A1.2 for Category A.
   ii. NF A35-557.
   iii. NF EN 10113-1 is cancelled and replaced by NF EN 10025:
   NF EN 10025-1,
   NF EN 10025-2,
   NF EN 10025-3,
   NF EN 10025-4,
   NF EN 10025-5,
   NF EN 10025-6.
   iv. For NF EN 10025 see section c.iii. above.
   v. For NF EN 10088-3 see section a.i. above
   vi. NF EN 10028-3.
   vii. NF A36-601 is cancelled and replaced by NF EN 10222:
   NF EN 10222-1
   NF EN 10222-2
   NF EN 10222-3
   NF EN 10222-4
   NF EN 10222-5
   viii. NF EN 10028-7.

d. From Appendix 1.4-3, FFDC01079EN:
    i. It corresponds to Standard NF A35-501 equivalent to Standard NF EN 10025 given above in section cc.iv. iii.
    ii. It corresponds to Standard NF EN 10025, see section c. iii.c.iv above.
    iii. NF EN 10045-1 is cancelled and replaced by NF EN ISO 148-1, see section b.i. above.
e. From Appendix 2.2-3, DOS-13-00081778-203_01 (Please find an affidavit as an attachment for the two documents transmitted below):
    i. AREVA NP document FS1-0004231, Revision 1.0: Volume Calculations of Various Fuel Rod Designs for Transport.
    ii. AREVA NP internal document FD-16-00285, Revision 1.0: Answers to French Safety Authority (ASN) Questions on EDGAR Tests and the Associated Zircaloy-4 Model.

OBSERVATIONS

Criticality Safety Evaluation

OBS-Cr-1

Provide the chemical composition of the chromium oxides as well as the concentration that will be present within uranium dioxide (UO_2).
Certificate of the French Competent Authority No. F/348/AF-96 (Revision Fq) for the Model No. FCC-4 packaging states that, for all contents, the UO_2 pellets may contain chromium oxides. The application does not include more specific information about the chemical composition of the chromium oxides including concentrations that will exist within the UO_2.
This information is needed to ensure compliance with the requirements in Paragraph 673 of the IAEA SSR-6, 2012 Edition

Chromium oxide blended with UO_2 is Chromium (III) oxide (or chromia) with the formula Cr_2O_3.

The nominal Cr concentration of 1600 ppm Cr_2O_3/UO_2, or 1250 ppm Cr/U, is targeted with a small fabrication variability range caused by:
- quality check measurement precision and,
- some variability of the fraction of chromia that volatilizes during sintering.

As stated in the Topical Report (TR) ANP-10340P, chromium content will be maintained within a range of [1250 +150/-450] microgram chromium per gram of uranium (µgCr/gU) for each pellet lot.

Ref. ANP-10340P, revision 0 “Incorporation of chromia-doped fuel properties in AREVA approved methods” – Approved by U.S. NRC – April 2018.

OBS-Cr-2

Justify that ignoring the inclusion of chromium oxide within the UO_2 is conservative with respect to criticality safety.
The following criticality analysis files state that the chromium oxides are ignored in the criticality analysis:
- *“107 SUNSI Encl 3 FCC 4 Ap 2.5-1 FFDC00817 EN” (“175 PUBLIC Encl 4 FCC 4 Ap 2.5-3 FFDC01106EN NPV”) that represents Contents Nos. 1, 2, 3, and 11 for the FCC-4, and*

- *"109 SUNSI Encl 3 FCC 4 Ap 2.5-2 FFDC01046EN.pdf" ("173 PUBLIC Encl 4 FCC 4 Ap 2.5-2 FFDC01046EN NPV") that represents Contents Nos. 4, 5, 6, 7, 8, 9, 10, and 12 for the FCC-4.*

These files state the following:
"The addition into the pellets of capturing compounds (chromium oxide for instance) in quantities close to those of the impurities is ignored in the study of criticality as their presence reduces the reactivity of the assemblies."
The staff has seen studies to support criticality safety analyses for other packages involving UO_2 fuel with chromium oxides that show that the reactivity effect of a specific quantity of chromium oxide may be statistically insignificant for a small number of rods. However, the staff requests justification that the proposed level of chromium oxide reduces reactivity if all rods contain chromium oxides.
This information is needed to ensure compliance with the requirements in Paragraph 673 of the IAEA SSR-6, 2012 Edition.

The presence of Cr_2O_3 in the fuel pellets in the assembly will have a negative reactivity effect due to the chromium capturing feature.

As observed by your staff, the reactivity effect of a specific quantity of chromium oxide may be statistically insignificant for a small number of rods and difficult to be quantified. If all rods contain the nominal chromium oxides content, the reactivity reduction remains a small effect and can be quantified by calculation.

For example: the introduction of the nominal Cr_2O_3 content (1600 µg/gUO_2) in all pellets of all fuel rods in the assembly leads to a decrease of about 40 pcm on the assembly's k_{inf}.

Containment Observation

OBS-Co-1

Provide the material classification for the contents described in Appendix 1 of the approval certificate for the FCC-4 packaging.
The material classification for each of the contents in Appendices 2 through 13 (excluding Appendix 9 which was not provided) of the approval certificate for the FCC-4 packaging is described as an activity that is less than 1 A2; however, the material classification was not similarly provided for the contents in Appendix 1 of the approval certificate for the FCC-4 packaging.
This information is needed to determine compliance with SSR-6 paragraph 429.

We can't explain this difference between the appendix 1 and the other appendices in the French Approval certificate. However, it is specified in the Appendix 1 that "Maximum activity level per packaging: The maximum activity of the content is less than 1 A2". Thus, it is implicit that the specification "Material classification: Activity less than 1 A2" is also available in this appendix.

AFFIDAVIT PURSUANT
TO 10 CFR 2.390

TN Americas LLC)
State of Maryland) SS.
County of Howard)

I, Prakash Narayanan, depose and say that I am Chief Technical Officer of TN Americas LLC, duly authorized to execute this affidavit, and have reviewed or caused to have reviewed the information which is identified as proprietary and referenced in the paragraph immediately below. I am submitting this affidavit in conformance with the provisions of 10 CFR 2.390 of the Commission's regulations for withholding this information.

The documents to be withheld from public disclosure are listed below:

NF EN 10088-3.
NF EN 485-2+A1.
NF EN ISO 148-1.
NF A35-557.
NF EN 10025-1,
NF EN 10025-2,
NF EN 10025-3,
NF EN 10025-4,
NF EN 10025-5,
NF EN 10025-6.
NF EN 10028-3.
FS1-0004231EN
D-FD-16-00285-EN
NF EN 10222-1
NF EN 10222-2
NF EN 10222-3
NF EN 10222-4
NF EN 10222-5
NF EN 10028-7.
47-0-01-99-01-00-2_I+A
47-0-01-99-01-02_J+A
47-0-01-99-01-06_F+A
47-0-01-99-01-09-1_G+A
47-0-01-99-01-09-2_G+A
47-0-01-99-01-16_E+A
47-0-01-99-01-22_A+A
PLA-16-00179264-201-00 EN
PLA-16-00179264-202-00 EN
PLA-16-00179264-202-00 EN
PLA-16-00179264-300-00 EN
FFP_NEEL-F 2008 DC 118EN_B_FIN Translated
FCC4 16x16 EN
FCC4 17x17 1300MWe EN
FCC4 17x17 1450MWe EN
FCC4 18x18 EN
Activated Slip Systems and Localized Straining of Irradiated Zr Alloys in Circumferential Loadings - C. Regnard, et. al.
CODAP 2005 - Appendix I1.A1 - Visual inspection
CODAP 2005 - Appendix I1.A2 - Dye penetrant test

I have personal knowledge of the criteria and procedures utilized by TN Americas LLC in designating information as a trade secret, privileged, or as confidential commercial or financial information.

Pursuant to the provisions of paragraph (b) (4) of Section 2.390 of the Commission's regulations, the following is furnished for consideration by the Commission in determining whether the information sought to be withheld from public disclosure, included in the above referenced documents, should be withheld.

1) The information sought to be withheld from public disclosure involves certain design details associated with the SAR analyses, calculations, and SAR drawings for the FCC-4 package, which are owned and have been held in confidence by TN International, or is intended for the exclusive and non-collective use by Orano for the U.S. Nuclear Regulatory commission (NRC) review of the application. TN Americas LLC and TN International are entities within the Orano organization. TN Americas LLC is acting on behalf of TN International to provide this information.

2) The information is of a type customarily held in confidence by TN Americas LLC and not customarily disclosed to the public. TN Americas LLC has a rational basis for determining the types of information customarily held in confidence by it.

3) Public disclosure of the information is likely to cause substantial harm to the competitive position of TN Americas LLC because the information consists of descriptions of the design and analysis of a radioactive material transportation system, the application of which provide a competitive economic advantage. The availability of such information to competitors would enable them to modify their product to better compete with TN Americas LLC, take marketing or other actions to improve their product's position or impair the position of TN America LLC's product, and avoid developing similar data and analyses in support of their processes, methods or apparatus.

Further the deponent sayeth not.

A. Prakash

Prakash Narayanan
Chief Technical Officer, TN Americas LLC

Subscribed and sworn before me this 24th day of June, 2020.

Notary Public
My Commission Expires 10/16/2023

RONDA JONES
NOTARY PUBLIC
MONTGOMERY COUNTY
MARYLAND
MY COMMISSION EXPIRES OCT. 16, 2023