
From: Michael.Conroy@dot.gov
Sent: Thursday, November 05, 2015 8:20 AM
To: Allen, William
Subject: [External_Sender] FW: TN-BGC1 Conference call - DRAFT RAI's

From: GALLAIS Gregory (AREVA) [mailto:gregory.gallais@areva.com]
Sent: Thursday, November 05, 2015 4:47 AM
To: Conroy, Michael (PHMSA)
Cc: DOUAUD Olivier (AREVA); GUIBERT Nicolas (AREVA); PHAM Tan Trieu (AREVA); MATHUES Glenn (AREVA); MALHAIRE Jean-Francois (AREVA); LE BLEVENNEC Renaud (AREVA); William.Allen@nrc.gov
Subject: RE: TN-BGC1 Conference call - DRAFT RAI's

Dear Mr. Conroy,

You will find hereafter the minutes of October,14th conference call on TN-BGC 1 validation.

- AREVA TN indicated that not giving credit for resin in HAC was not acceptable since the decrease of allowable mass would be too important to satisfy business needs
- NRC criticality reviewer mentioned he could not take position on the content of technical note NTC-08-00118662 rev.1 : a material reviewer is needed
- AREVA TN brought additional arguments in response to the preparatory questions you transmitted (see end of this e-mail)
- It was not possible to clearly identify what has to be done in order to make the assumption of having a remainder of 33 mm of resin during HAC acceptable to NRC

Should you have any comment or question about these minutes, do not hesitate to contact me

Important additional Information not discussed during the meeting :

*We are aware that not giving credit for resin would be the easiest way to conclude this topic.
We are thus exploring more specifically the possibility to satisfy transport needs with the lower masses which would be obtained by not giving credit for resin in HAC criticality calculations.
As for now, since we have no certainties on this point, we have to consider that not giving credit for resin in HAC is not acceptable.
We will come back to you as soon as possible to discuss the results and let you know if we maintain our position on giving credit for resin.*

As for now, we would appreciate if you could ask for a material reviewer to examine our technical note and take position on the relevance of the assumption of giving credit for resin in HAC.

We are aware that the analysis may require a longer time and we accept it.

In order to ease the understanding of the situation by the material reviewer, we proposed to send an e-mail which covers what has been discussed during the meeting.

You will find these elements below :

0. At what temperature does the resin begins to lose its structural rigidity? That is to say, at what temperature does the resin start to slump or melt?

The resin used is a polyester based resin. An inherent characteristic of such a material is that it is thermoset (i.e. not thermoplastic).

As a consequence, there is no melting point. This explains that fire tests on resins samples showed no melting of the samples.

1. Would the remaining resin after the HAC fire still be uniformly attached to the (outer wall of) the inner shell that houses the resin? How do you know? There is no test to show that.

The fact that resin is attached to the inner shell of the casing is not a safety parameter. From a criticality point of view, only the presence of the resin between package inner and outer shell is important, not its position : as a matter of fact, for the same thickness of resin and the same fissile material, any slight radial displacement of resin in its casing will have no significant impact on Keff.

Moreover, as stated in §3.2.2 of NTC-08-00118662 rev.1, the physical characteristics of resin are only impacted on the first 4 mm of the face exposed to a flame at 800°C. These 4 mm are obtained after scratching the burnt area, additional scratching does not lead to a deeper crater.

Thus, if the resin could be scratched in its casing after HAC, the displacement of resin would be limited to a maximum radial displacement of 4 mm.

2. What are the material and mechanical properties of the resin after the HAC fire?

Only Hydrogen and Boron content is meaningful for the purpose of criticality safety analyses.

These material properties after HAC thermal tests are treated by the technical note NTC-08-00118662 rev.1 on resin in the last table of §3.2.2.

Regarding the mechanical properties, in addition to the fact that the resin is thermoset, the observation clearly shows that there is no melting of the resin.

During direct flame fire test, only the area directly exposed to the flame was impacted: ie. charred, not melted.

Moreover, since HAC thermal assessment should be done after HAC mechanical analyses (see IAEA art. 726), there is no significant mechanical solicitations on the package after fire conditions.

3. Also, as indicated, the resin will lose almost all of its hydrogen, the model did not explain that. What is the explanation?

In the technical note NTC-08-00118662 rev.1, it is not indicated that the resin lose almost all its hydrogen. It is written that the resin lose between 90% and 0% of its hydrogen in the first 25 mm only i.e. the loss in hydrogen follows a gradient from 90% to 0% from the face exposed to the fire conditions to a depth of 25 mm.

It has to be mentioned that this loss was measured after the furnace test which was conducted under very severe conditions (regulation requires 30 min at 800°C) :

- 30 min between 600°C and 800°C
- 30 min at 800°C

The loss in hydrogen is thus over estimated by the furnace test.

In order to ease the modeling of resin, a calculation is made to convert this graduated loss into a full loss of hydrogen, leading to an equivalent thickness loss of 14,25mm.

In comparison, during direct flame fire tests on resin samples (30 min at 800°C), the equivalent thickness loss is less than 10mm.

In criticality calculations, a penalizing value of 15 mm of the resin thickness is removed to take into account the chemical and physical states of resin after fire conditions, leading to a remainder of resin of 33 mm (48 mm - 15 mm).

We hope these elements will help the assessment of TN-BGC 1 validation.

Should you have any comment or question about them, do not hesitate to contact me

Best regards,

Grégory GALLAIS

Design Manager – Special Material Engineering Unit

Phone : (+33) 1 34 96 53 81 | Fax : (+33) 1 34 96 54 56 | Email : gregory.gallais@areva.com

De : Michael.Conroy@dot.gov [mailto:Michael.Conroy@dot.gov]
Envoyé : jeudi 8 octobre 2015 16:30
À : GALLAIS Gregory (BE/LO)
Cc : DOUAUD Olivier (BE/LO); GUIBERT Nicolas (BE/LO); PHAM Tan Trieu (BE/LO); MATHUES Glenn (BE/LO)
Objet : RE: TN-BGC1 Conference call - DRAFT RAI's

Okay , we are on for next Wednesday, October 14, 11 am – noon, EDT.

Domestic Bridge Line: 888-447-9153
International Bridge Line: 1-517-645-6483
Pass Code: 30582

As preparation, I offer the following:

The NRC reviewer questions on the resin are mainly this:

1. Would the remaining resin after the HAC fire still be uniformly attached to the (outer wall of) the inner shell that houses the resin? How do you know? There is no test to show that.
2. What are the material and mechanical properties of the resin after the HAC fire?
3. Also, as indicated, the resin will lose almost all of its hydrogen, the model did not explain that. What is the explanation? It does not look like the resin document answers these questions.

In addition, I am told the NRC has never given credit for resin-like material in the hypothetical accident conditions. They will need a good deal of information to convince them to change their technical position on this issue. They have also indicated that in this case, they will need to add a material and thermal reviewer to the review – this will add probably 2 months to the review time, and perhaps longer.

I'm not sure of your transport needs, but as they suggested, if you could tolerate assignment of a higher CSI (by not taking any credit for the resin after the HAC), the review path should be much easier. Of course, it is entirely your decision as to whether that would be acceptable.

From: GALLAIS Gregory (AREVA) [mailto:gregory.gallais@areva.com]
Sent: Thursday, October 08, 2015 9:21 AM
To: Conroy, Michael (PHMSA)
Cc: DOUAUD Olivier (AREVA); GUIBERT Nicolas (AREVA); PHAM Tan Trieu (AREVA); MATHUES Glenn (AREVA)
Subject: RE: TN-BGC1 Conference call - DRAFT RAI's

Next Wednesday or next Thursday would be fine.

De : Michael.Conroy@dot.gov [mailto:Michael.Conroy@dot.gov]
Envoyé : jeudi 8 octobre 2015 15:14
À : GALLAIS Gregory (BE/LO)
Objet : RE: TN-BGC1 2016 Shipment Date & Content Question

Just found out the criticality reviewer is not available today. We will reschedule today's call for another time. Sorry for the late notice. When would be good for you next week?

From: GALLAIS Gregory (AREVA) [mailto:gregory.gallais@areva.com]
Sent: Thursday, October 08, 2015 3:32 AM
To: Conroy, Michael (PHMSA)
Subject: RE: TN-BGC1 2016 Shipment Date & Content Question

Thank you for this quick feedback Mr Conroy.

PS : People from TN Inc. may also be there at the conference call, it is not confirmed yet.

Regards,

Grégory GALLAIS

Design Manager – Special Material Engineering Unit

Phone : (+33) 1 34 96 53 81 | Fax : (+33) 1 34 96 54 56 | Email : gregory.gallais@areva.com

De : Michael.Conroy@dot.gov [<mailto:Michael.Conroy@dot.gov>]

Envoyé : mercredi 7 octobre 2015 21:56

À : GALLAIS Gregory (BE/LO)

Objet : RE: TN-BGC1 2016 Shipment Date & Content Question

1. Could you please confirm that there is no misunderstanding and that the question is indeed related to content 11 only ?

NRC confirms that the questions are related to content 11 only.

2. PS : regarding the Proprietary Document Requirements, we are working on it and a question was raised : is a signature from a notary public (or equivalent) necessary in addition to the signature of an official from our company ?
I don't think a notary signature is required – Chris Allen is double-checking on that.

From: GALLAIS Gregory (AREVA) [<mailto:gregory.gallais@areva.com>]

Sent: Tuesday, October 06, 2015 11:27 AM

To: Conroy, Michael (PHMSA)

Subject: RE: TN-BGC1 2016 Shipment Date & Content Question

Dear Mr Conroy,

Reading the draft RAI's you sent mid September it occurred to me that there might have been a misunderstanding on RAI 2 and 3 of criticality.

Indeed, the reviewer stated that : "*In its application letter, dated July 9, 2015, the applicant requested approval of the TN-BGC 1 package for "the transport and storage of fissile material in very varied forms such as ingots of plutonium or metallic uranium, powders consisting of plutonium oxide or highly enriched uranium, and liquids such as uranyl nitrate."*

However, this sentence at the beginning of our letter is only given to provide some context to the reviewer. The approval is only requested for content 11 (except 11h) and 26 which, as indicated in the application letter, are for non-irradiated uranium bearing materials in any solid form and TRIGA fuel respectively.

Could you please confirm that there is no misunderstanding and that the question is indeed related to content 11 only ?

PS : regarding the Proprietary Document Requirements, we are working on it and a question was raised : is a signature from a notary public (or equivalent) necessary in addition to the signature of an official from our company ?

Best regards,

Grégory GALLAIS

Design Manager – Special Material Engineering Unit

Phone : (+33) 1 34 96 53 81 | Fax : (+33) 1 34 96 54 56 | Email : gregory.gallais@areva.com

De : Michael.Conroy@dot.gov [<mailto:Michael.Conroy@dot.gov>]

Envoyé : mardi 15 septembre 2015 19:21

À : GALLAIS Gregory (BE/LO)

Cc : LE BLEVENNEC Renaud (BE/LO); THOMAS Jay (BE/LO); GUIBERT Nicolas (BE/LO)

Objet : RE: TN-BGC1 2016 Shipment Date & Content Question

Grégory -

Below is a partial draft of NRC's "Request for Additional Information" (RAI). This covers only issues from the criticality and materials reviewers. Additional items will be provided at a later date.

These are provided for your review and to allow you additional time in preparing your responses.

If you wish to discuss these items with the reviewers, I can arrange a conference call with the NRC.

Regarding the schedule, the NRC plans to issue the final RAI by the end of October.

Assuming that you can provide satisfactory responses by the end of November, we may be able to issue a certificate by the end of January.

DRAFT Request for Additional Information

Criticality Review

1. Clarify if changes were made to the packaging for TRIGA fuel and provide corresponding safety analyses if necessary.

In its application letter, dated July 9, 2015, the applicant requests approval of the TN-BGC 1 package for TRIGA fuel (content No. 26 in French Competent Authority Certificate F/313/B(U)F-96, Rev. Jbb). The applicant needs to clarify if a new TRIGA fuel type will be shipped, if different packaging materials or packaging methods were used, etc. If necessary, submit additional criticality safety analysis for either content changes or operational changes associated with TRIGA fuel or demonstrate that the analyses for the approved TRIGA fuel package bound the new contents or packaging methods used.

The staff needs this information to determine the TN-BGC1 package with requested contents meets the regulatory requirements of para. 673 to 683 of the IAEA TS-R-1, 2009 edition.

2. Provide criticality safety calculations for the uranium oxides (UO_2 , UO_3 , U_3O_8); uranium tetrafluoride (UF_4); uranium nitrides (UN , U_2N_3 , UN_2); uranium carbides (UC , UC_2 and U_2C_3); and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si); and zirconium (Zr) and USL values for each type of the requested contents.

In its application letter, dated July 9, 2015, the applicant requested approval of the TN-BGC 1 package for "the transport and storage of fissile material in very varied forms such as ingots of plutonium or metallic uranium, powders consisting of plutonium oxide or highly enriched uranium, and liquids such as uranyl nitrate." The applicant further clarified that, in addition to metallic uranium in powder form, the requested contents also include uranium oxides (UO_2 , UO_3 , U_3O_8), uranium tetrafluoride (UF_4), uranium nitrides (UN , U_2N_3 , UN_2), uranium carbides (UC , UC_2 and U_2C_3) and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si), and zirconium (Zr). However, the criticality safety analyses provided in TN-BGC1-0601, dated June 16th, 2015, only address pure uranium metal. The applicant needs to provide criticality safety analyses for the TN-BGC1 package containing uranium oxide (UO_2 , UO_3 , U_3O_8) powders, uranium tetrafluoride (UF_4), uranium nitrides (UN , U_2N_3 , UN_2), uranium carbides (UC , UC_2 and U_2C_3) and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si), and zirconium (Zr).

The staff needs this information to determine the TN-BGC1 package with requested contents meets the regulatory requirements of para. 673 to 683 of the IAEA TS-R-1, 2009 edition.

3. Provide justification that the selected critical benchmark experiments are appropriate for the criticality safety calculations for the requested contents or provide additional benchmark for the powder form uranium oxides (UO_2 , UO_3 , U_3O_8), uranium tetrafluoride (UF_4), uranium nitrides (UN , U_2N_3 , UN_2), uranium carbides (UC , UC_2 and U_2C_3) and uranium alloyed with aluminum (Al), molybdenum (Mo), silicon (Si), and zirconium (Zr) and corresponding USL for each of the contents.

In TN-BGC1-0600, dated June 11, 2015, the applicant provided code benchmarking analyses for the SCALE 6.0 computer code used for the TN-BGC1 criticality safety analyses. However, it appears that all selected critical

experiments are associated with uranium metal, and that none of the selected critical experiments apply to the other content forms. As such, it is not clear how the selected critical experiments are applicable to the requested contents. The applicant needs to either justify that the selected critical experiments are appropriate for the criticality analyses of the requested contents or revise its code benchmark analyses to include critical experiments that are applicable to all requested contents.

The staff also notes that the upper safety limit (USL) values provided by the applicant are a function of enrichment, energy of average lethargy causing fission (EALF), hydrogen to fissile material (H/X) ratio, mean free path (MFP), and neutron fission yield for metallic uranium only. However, the applicant did not provide USL values for each content or a bounding USL value for all requested contents. The applicant needs to provide USL values for all of these parameters for each type of requested content or a bounding value for all of requested contents.

The staff needs this information to determine the TN-BGC1 package with the requested contents meets the regulatory requirements of para. 673 to 683 of the IAEA TS-R-1, 2009 edition.

4. Provide justification for the credit taken for the remainder of the burned neutron shield in the criticality analyses for the packages under hypothetical accident conditions.

On page 7 of TN-BGC1-0601, dated June 16, 2015, the applicant states, "For the HAC case, part of the resin is replaced with air (Table presented in Appendix C shows that using air is more conservative than water. ...)". However, the basis for taking credit for both the presence of the burned neutron shield and the material composition of the burned neutron shield under hypothetical accident conditions (HAC)/accident conditions of transport (ACT) is unclear. Specifically, staff is unable to find proof in the safety analysis report that the burned resin will remain uniformly attached to the outer surface of the overpack inner shell as assumed in the model shown in Figure 11-1. The applicant needs to justify the credit taken for the burned neutron shield in the criticality analyses for the packages under HAC/ACT.

The staff needs this information to determine the TN-BGC1 package with powder form highly enriched uranium and plutonium dioxide meets the regulatory requirements of para. 681 to 683 of the IAEA TS-R-1, 2009 edition.

Materials Review

1. Provide further rationales (justification, or basis) for eliminating the possibility for a pyrophoric reaction. Although the applicant addressed this issue previously, the response requires further information as stated below:
 - a. The applicant does not present sufficient information on drying conditions of uranium metallic powder both prior to and after inerting.

The applicant partially provided information on this issue in response to staff's 2014 RAI. Inadequate drying may cause the metallic powder to react with water. Before inerting at 1 bar, the cavity is placed under a 1 mbar vacuum. This operation is repeated two consecutive times. However, the time duration for the 1mbar vacuum is not specified. ASTM C1553 (from PNL-6365) specifies 4 mbar for at least 30 minutes following evacuation. If this condition is not obtained, other industry practices monitor the gas pressure while inerting after vacuum drying. Because clogged, or (chemically or physically) sorbed water is potentially present, the inert gas pressure may be required to be monitored longer time.
 - b. The applicant states that, for the amount of uranium shipped, the quantity of air which could enter the cavity is insufficient to sustain a continuous pyrophoric reaction. However, the basis for this assessment may not cover a full range of gas intrusion conditions. For example, water (or moisture) may also intrude in addition to gas. In the accident analysis, water intrusion was assumed outside the cavity. Water alone or oxygen (with hydrogen) by radiolysis can also react with the metallic powder.
 - c. The applicant states that the temperature will not exceed 144 °C. If the metallic powder reacts with any oxygen that may enter penetrate the containment, the temperature may go up due to exothermic reactions of the metallic uranium with oxygen in either water or air.

- d. The applicant does not discuss how its assessment of pyrophoricity complies with the UN Recommendations on the Transport of Dangerous Goods.

The staff needs this information to proceed with its review per para. 506, TS-R-1 (2009 Edition).

2. Provide detailed information on the gas pressure increase due to radiolysis and thermolysis under HAC/ACT.

It is unclear what causes the gas pressure to increase to approximately 0.5 MPa.

The staff needs this information to proceed with its review per para. 506, TS-R-1 (2009 Edition).

From: Conroy, Michael (PHMSA)
Sent: Tuesday, September 15, 2015 11:48 AM
To: 'GALLAIS Gregory (AREVA)'
Cc: LE BLEVENNEC Renaud (AREVA); THOMAS Jay (AREVA); GUIBERT Nicolas (AREVA)
Subject: RE: TN-BGC1 2016 Shipment Date & Content Question

Yes, I received your email of September 2.

The NRC reviewers are working on a list of items for their "Request for Additional Information" which I should have from them soon.

The schedule will depend on how extensive that list is and how quickly you can provide the requested information.

From: GALLAIS Gregory (AREVA) [mailto:gregory.gallais@areva.com]
Sent: Tuesday, September 15, 2015 11:43 AM
To: Conroy, Michael (PHMSA)
Cc: LE BLEVENNEC Renaud (AREVA); THOMAS Jay (AREVA); GUIBERT Nicolas (AREVA)
Subject: RE: TN-BGC1 2016 Shipment Date & Content Question

Dear Mr Conroy,

Could you please let me know if you received my last e-mail and if the update of NRC review schedule is compatible with the estimated period of transport ?

Best regards,

Grégory GALLAIS
Design Manager – Special Material Engineering Unit
Phone : (+33) 1 34 96 53 81 | **Fax :** (+33) 1 34 96 54 56 | **Email :** gregory.gallais@areva.com

De : GALLAIS Gregory (BE/LO)
Envoyé : mercredi 2 septembre 2015 17:23
À : 'Michael.Conroy@dot.gov'
Cc : MALHAIRE Jean-Francois (BE/LO); LE BLEVENNEC Renaud (BE/LO); STACHETTI Laurent (BE/LO)
Objet : RE: TN-BGC1 2016 Shipment Date & Content Question

Dear Mr Conroy,

I finally got complements on the shipment date for TN-BGC 1. The transport may occur during Jan. or Feb. 2016.

Regarding the question on reprocessed uranium, NRC can indeed assume there is no Pu in Content 11.

Cordialement,

Grégory GALLAIS
Responsable Etudes – Section Etudes Matières Spéciales
Phone : (+33) 1 34 96 53 81 | **Fax :** (+33) 1 34 96 54 56 | **Email :** gregory.gallais@areva.com

De : Michael.Conroy@dot.gov [mailto:Michael.Conroy@dot.gov]

Envoyé : vendredi 28 août 2015 21:20

À : GALLAIS Gregory (BE/LO)

Objet : RE: TN-BGC1 2016 Shipment Date & Content Question

Do you have an answer on the shipment date yet?

Also – a new question for you:

In Appendix 1 of your letter of 25th June 2015 (CEX-15-00117104-001), you stated, “Transport of reprocessed uranium is prohibited.”

Annex 11 of the French certificate says, “This content comprises uranium-based solids. The presence of traces of plutonium, in the order of grammes, is permitted. The uranium is non-irradiated. In the event that the uranium is reprocessed, the material should not have been irradiated at any moment post-reprocessing.”

Given these facts, the NRC has asked me if our review needs to account for the presence of any plutonium in Content 11, or may we assume there is none?

Please advise.

From: GALLAIS Gregory (AREVA) [mailto:gregory.gallais@areva.com]

Sent: Monday, August 17, 2015 3:55 AM

To: Conroy, Michael (PHMSA)

Subject: RE: TN-BGC1 2016 Shipment Date

Dear Mr Conroy,

I am not yet in a position to provide you a more specific shipment date for TN-BGC 1, however, I should receive this information by the end of august.

I will contact you then.

Regards,

Grégory GALLAIS

Design Manager – Special Material Engineering Unit

Phone : (+33) 1 34 96 53 81 | **Fax :** (+33) 1 34 96 54 56 | **Email :** gregory.gallais@areva.com

De : Michael.Conroy@dot.gov [mailto:Michael.Conroy@dot.gov]

Envoyé : lundi 10 août 2015 15:04

À : GALLAIS Gregory (BE/LO)

Objet : TN-BGC1 2016 Shipment Date

In your 25th June 2015 letter (regarding TN-BGC 1 package - Application for American validation of the French certificate of approval F/313/B(U)F-96 (Jbb) for the package consisting of the TN-BGC1 packaging loaded with contents n°11 or n°26), you stated, “For your information, a transport of LEU from the Y12 facility (USA) to CERCA facility (France) is tentatively scheduled for the beginning of 2016.”

The NRC is re-working their review schedule and has asked me if you could provide a more precise shipment date.

Do you have a specific date planned yet?

Michael Conroy

Division of Engineering and Research / Office of Hazardous Materials Safety

Pipeline and Hazardous Materials Safety Administration

U.S. Department of Transportation

East Building, PHH-23
1200 New Jersey Avenue, S.E.
Washington, D.C. 20590-0001
Michael.Conroy@dot.gov
(202) 366-3597

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Thu, 5 Nov 2015 08:20:28 -0500

From: <Michael.Conroy@dot.gov>

To: <William.Allen@nrc.gov>

Thread-Topic: TN-BGC1 Conference call - DRAFT RAI's

Thread-Index: AdEBzCscwiqnBW3GTgSB9gN2w+xGVQACPBdAAZTgTkAD6QamsA==

Date: Thu, 5 Nov 2015 13:20:28 +0000

Message-ID: <4E031F7F3787CF43B0E2E7545D22EB9783117085@DOHQNWMS360VG.ad.dot.gov>

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MIME-Version: 1.0

Return-Path: prvs=744eb3eea=Michael.Conroy@dot.gov

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X-MS-Exchange-Organization-AuthSource: HQPWMSMRS06.nrc.gov

X-MS-Exchange-Organization-AuthAs: Anonymous