

From: [WILLIFORD Dennis \(AREVA\)](#)
To: [Love, Earl](#)
Cc: [SHAW JR Donis \(AREVA\)](#); [BONDRE Jayant \(AREVA\)](#); [SHIH Yueh Kan \(AREVA\)](#); [NARAYANAN Prakash \(AREVA\)](#); [MATHUES Glenn \(AREVA\)](#); [VENIGALLA Venkata \(AREVA\)](#); [ABRAHAM Jibu \(AREVA\)](#)
Subject: [External_Sender] FW: Thermal Inquiry
Date: Thursday, April 20, 2017 12:07:31 PM
Attachments: [TN Americas LLC Clarification_NRC Inquiry of 18 April 2017.pdf](#)
Importance: High

Earl,

Since Don Shaw is out of the office today, he requested that I respond on his behalf to your email below.

We have provided some additional clarification in the attached file to the items you requested. Please let me know if you have questions or need further information.

Regards,

Dennis Williford

DENNIS WILLIFORD, P.E.

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From: Love, Earl [<mailto:Earl.Love@nrc.gov>]

Sent: Tuesday, April 18, 2017 5:09 PM

To: SHAW JR Donis (LO)

Subject: Thermal Inquiry

Don,

The results of TNs 72.48 evaluation (LR 721004-1586) for the thermal performance of a new 32PTH1 Type 2-W basket concluded a 3°F and 5°F margin for the fuel cladding under storage conditions and transfer conditions, respectively, based on a peak cladding temperature limit of 752°F. The 72.48 evaluation described several conservatisms used in the analysis as a means to claim adequate margin. The NRC staff has reviewed the 72.48 and did not find quantifiable conservatisms, modeling and application uncertainties (see NUREG-2152 "Computational Fluid Dynamics Best Practice Guidelines for Dry Cask Applications"), errors or a solution verification. As a result, the staff is seeking to gain a better understanding and is requesting clarification by TN to quantify how conservatisms, uncertainties, and errors accounted for in the thermal model affect the thermal analysis in a way that demonstrates the storage cask provides adequate heat removal capacity and gives assurance that the predicted peak cladding temperature (PCT) will not exceed the recommended 752°F limit.

The NRC thermal staff members will be available by phone tomorrow should the need arise to

discuss this further and to provide any additional information that may be needed in order to assist in resolution. Please do not hesitate to email or call me at 301-415-7011.

Thank You,

Earl Love
Sr. Transportation and Storage Safety Inspector
Office of Nuclear Material Safety & Safeguards
Division of Spent Fuel Management
Inspections and Operations Branch

**Additional Clarification from TN Americas LLC to NRC Inquiry in email from Earl Love of 5:09 p.m. on
18 April 2017**

TN has split the NRC inquiry into three distinct aspects, shown below, in order to clearly address these items.

1. The results of TNs 72.48 evaluation (LR 721004-1586) for the thermal performance of a new 32PTH1 Type 2-W basket concluded a 3°F and 5°F margin for the fuel cladding under storage conditions and transfer conditions, respectively, based on a peak cladding temperature limit of 752°F.
2. The 72.48 evaluation described several conservatisms used in the analysis as a means to claim adequate margin. The NRC staff has reviewed the 72.48 and did not find quantifiable conservatisms, modeling and application uncertainties (see NUREG-2152 "Computational Fluid Dynamics Best Practice Guidelines for Dry Cask Applications"), errors or a solution verification.
3. As a result, the staff is seeking to gain a better understanding and is requesting clarification by TN to quantify how conservatisms, uncertainties, and errors accounted for in the thermal model affect the thermal analysis in a way that demonstrates the storage cask provides adequate heat removal capacity and gives assurance that the predicted peak cladding temperature (PCT) will not exceed the recommended 752°F limit.

Regarding Item 1:

As noted in LR 721004-1586 Rev. 0, these margins are for damaged fuel assemblies that have no regulatory bases for temperature limits. The margins for intact fuel assemblies in LR 721004-1586 Rev. 0 are 24°F for storage and 15°F for transfer conditions.

Regarding Item 2:

On Page 4 of Form 3.5-3, Evaluation for LR 721004-1586 Rev. 0, TN provided an overview of the significant conservatisms employed in the original methodology that was reviewed and approved by the NRC in Amendment 10 to CoC 1004.

The amount of conservatism in this methodology can be assessed by comparing the maximum fuel cladding temperatures determined in LR 721004-1432 Rev.1 using methodology from a different CoC (CoC 1029) to those presented in LR 721004-1586 Rev.0, which is based on the methodology described in the UFSAR for the 32PTH1 DSC. TN believes that the comparison between the two methodologies is appropriate to judge the conservatism since both methodologies have been reviewed and accepted by NRC, albeit in different CoCs for very similar systems.

This comparison is only intended to provide an estimate of the conservatism. This estimate is not considered by TN to be a part of the licensing basis for the 32PTH1 Type 2-W DSC, consistent with the Notice of Violation [1].

**Additional Clarification from TN Americas LLC to NRC Inquiry in email from Earl Love of 5:09 p.m. on
18 April 2017**

**Comparison of Maximum Fuel Cladding Temperature between
LR 721004-1432 Rev.1 and LR 721004-1586 Rev.0**

Condition	LR 721004-1432 Rev.1 (°F)	LR 721004-1586 Rev.0 (°F)	Conservatism in Calculated Cladding Temperature (°F)	Cladding Temperature Limit (°F)
Normal Storage, Intact FAs	690	728	38	752
Normal Storage, Damaged FAs	711	749	38	N/A*
Normal Transfer, Intact FAs	654	737	83	752
Normal Transfer, Damaged FAs	659	747	88	N/A*

* In CoC 1004 Amendment 10, a temperature limit of 752°F was conservatively assumed for damaged fuel assemblies.

Further, it should be noted that the temperature difference of 38°F for storage conditions between the two methodologies also agrees very well with the predicted conservatism based on the thermal test of HSM-H as described in Page 4 and 5 of Form 3.5-3, Evaluation for LR 721004-1586 Rev. 0. This provides an additional level of confidence that the predicted fuel cladding temperatures are conservative.

Regarding Item 3:

Because the methodology used in this LR is based on a methodology which was already reviewed and approved by the NRC in Amendment 10 to CoC 1004, TN does not understand why it is necessary to quantify "how conservatisms, uncertainties, and errors accounted for in the thermal model affect the thermal analysis in a way that demonstrates the storage cask provides adequate heat removal capacity and gives assurance that the predicted peak cladding temperature (PCT) will not exceed the recommended 752°F limit." All of the items requested in this inquiry were previously reviewed and approved by the NRC.

NUREG-2152 was not in effect at the time of approval of Amendment 10 to CoC 1004. The approach described in NUREG-2152 was not part of the licensing basis for Amendment 10 to CoC 1004 in which the 32PTH1 DSC was reviewed and approved by the NRC.

Reference:

1. Letter from Patricia Silva (NRC) to Jayant Bondre (TN), "U.S. NUCLEAR REGULATORY COMMISSION IN-OFFICE REVIEW AND NOTICE OF VIOLATION," dated February 13, 2017 (ML17009A122).