NRC FORM 699 (9-2003) U.S. NUCLEAR REGULATORY COMMISSION

CONVERSATION RECORD

DATE: 10/18/2007

TIME: 1:00pm

NAME OF PERSON(S) CONTACTED OR IN CONTACT WITH YOU	TELEPHONE NO.
Don Shaw, et al.	410-910-6878

ORGANIZATION: Transnuclear Inc. (TN)

SUBJECT: NRC staff confirmatory thermal evaluation associated with Amendment 10 to the Standardized NUHOMS design. (Docket 72-1004)

TYPE OF CONVERSATION: ☐ VISIT ☐ CONFERENCE ☐ TELEPHONE ☑ INCOMING ☐ OUTGOING

SUMMARY *(Continue on Page 2)*

Summary of 10/05/07 phone call with Transnuclear to discuss requests for additional information associated with Amendment 10 to the Standardized NUHOMS design (docket 72-1004)

On 10/18/07 staff from the Division of Spent Fuel Storage and Transportation held a phone call with Transnuclear, Inc. to discuss the staff's confirmatory thermal analysis associated with Amendment 10 to the Standardized NUHOMS design. The participants in the call were:

Transnuclear (TN): Jayant Bondre, Don Shaw, Slava Guzeyev (TN thermal lead), Gregory Banken (TN consultant), Kamran Tavassoli (TN consultant), Davy Qi (TN thermal analyst), Venkata Venigalla (TN thermal analyst)

NRC: Christopher Bajwa, Jennifer Davis, Joe Sebrosky

Pacific Northwest National Laboratory (NRC Contractor): Harold Adkins, Judith Cuta, James Fort

The phone call was a follow on to discussions that the staff had with TN in a September 19, 2007, meeting (see ADAMS accession number ML072780244 for a summary of the meeting). Specifically, the staff committed in the meeting to provide TN with a hi-level discussion of the results of its confirmatory thermal calculations so that TN could consider the results in the response to the thermal RAIs. The agenda for the phone call appears below.

Agenda

I. Hi-level discussion of NRC's confirmatory evaluation
a) Description of models
-Horizontal Storage Module-h (HSM-H)
-OS 200 Transfer Cask (TC)

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ACTION REQUIRED

(See page 4 for action items)

NAME OF PERSON DOCUMENTING CONVERSATION	SIGNATURE	DATE
B. Jennifer Davis	B. Jennifer Davis	10/24/2007

ACTION TAKEN

TITLE OF PERSON TAKING ACTION	SIGNATURE OF PERSON TAKING ACTION	DATE

CONVERSATION RECORD (Continued)

SUMMARY *(Continue on Page 3)*

II. Discussion of results
a)HSM-H
-areas of conservatisms
-areas of non-conservatisms
b)OS-200 TC
-areas of conservatisms
-areas of non-conservatisms
- modeling of the liquid neutron shield in the OS-200 TC
-relationship to NUHOMS HD design

III.TN and NRC dialogue regarding results

IV Ramification
a)Impact on staff safety evaluation report
b)Impact on future changes to Standardized NUHOMS design

HIGHLIGHTS OF THE PHONE CALL

Regarding Item 1(a) Ç Description of models

Horizontal Storage Module (HSM-H)

PNNL provided a brief description of the StarCD model of the 32PTH1 DSC within the HSM-H. This model consists of a fine-mesh representation of the DSC internals, and detailed modeling of the HSM-H enclosure, including interior heat shields, the I-beam rails supporting the DSC, and complete geometric representation of the flow path for natural circulation of air around the DSC. In response to questions from TN, PNNL discussed the model in more detail, explaining that the DSC was represented in the StarCD model using the homogeneous k-effective model for the fuel, with detailed noding of the basket plates, transition rails, and DSC shell. The model included geometric assumptions from the SAR model for gaps between components (e.g., between basket plates, between rail structures and basket), to facilitate direct comparison between confirmatory calculations and SAR results.

PNNL also provided details on the COBRA-SFS model of the DSC, in response to questions from TN. This model was used extensively to verify the StarCD model for accuracy and completeness, and also provided confirmatory calculations using boundary temperatures on the DSC shell provided by TN from the ANSYS calculations supporting the results reported in the SAR.

OS200 Transfer Cask (TC)

PNNL provided a detailed description of the StarCD model of the OS200 transfer cask, in response to questions from TN. This model represents a single segment of the horizontal cask, encompassing one annular enclosure of the neutron shield tank, which is divided into 16 segments by thin steel support fins. For these calculations, the heat flux from the COBRA-SFS model of the DSC within the Transfer Cask was used to specify the boundary condition on the inner surface of the transfer cask inner liner. Heat transfer coefficient values determined from COBRA-SFS calculations were specified as boundary conditions around the circumference of the shield tank outer shell, with ambient temperature of 117 F (47 C). The StarCD code solved directly for the hydrodynamics of the flow within the neutron shield tank segment from these boundary conditions, and the resulting temperature distribution from the inner to the outer wall of the transfer cask.

PNNL also provided a description of the COBRA-SFS model of the DSC within the Transfer Cask. In response to questions from TN, PNNL explained that the DSC model was identical to the COBRA-SFS model of the DSC within the HSM-H, with the addition of flow channels representing the air annulus between the DSC and the TC inner liner, and conduction nodes representing the various layers comprising the transfer cask (i.e., the inner liner, the lead gamma shield, the cask outer shell, and the neutron shield tank.) The model is essentially three-dimensional, including end effects. However, it conservatively represents heat transfer through the neutron shield tank as conduction only through the liquid and the steel support fins.

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CONVERSATION RECORD (Continued)

SUMMARY *(Continue on Page 4)*

Regarding item II(a) Ç Discussion of Results

Horizontal Storage Module (HSM-H) Ç areas of conservatism

PNNL supported the Technical Monitor's description of the general conservatism of the SAR results for the HSM-H, providing details on specific margins as requested. PNNL discussed the larger conservatism in the SAR results for the DSC with Type 1 basket and 40.8 kW, resulting from using artificially inflated boundary temperatures from a calculation assuming a 40.8 kW heat load with the Type 2 basket (which is not an allowed configuration for this storage system.) PNNL noted that this approach, while definitely conservative, was inconsistent with the approach used for the DSC with Type 2 basket and 31.2 kW heat load. As a result, the margin is narrower for the DSC with the Type 2 basket. This approach tends to confound objective evaluation of the actual conservatism in the SAR analyses.

Horizontal Storage Module (HSM-H) Ç areas of non-conservatism

PNNL described in detail results of the StarCD calculations that show higher temperatures on the DSC shell than predicted with the SAR's correlation-based heat transfer model for natural convection in the vicinity of the I-beam supporting the DSC within the HSM-H. These results indicate that the heat transfer model is non-conservative in this region.

TN did not dispute this possibility, but argued that this would have very little impact on peak clad temperature within the DSC. PNNL agreed that the non-conservatism in this case was unlikely to result in peak clad temperatures above the regulatory limits, but noted that this behavior of the SAR model is typical of correlations that do not have a physical basis. The point of noting this behavior is to alert TN and NRC to the dangers of extrapolating correlation-based models to conditions beyond their range of applicability. Such models should always be checked against more rigorous evaluations, to assure they remain conservative, particularly when they are intended as conservative representations of complex heat transfer behavior.

Regarding item II(b) Ç Discussion of Results

OS200 Transfer Cask (TC) Ç areas of non-conservatism

PNNL provided detail descriptions of the modeling and calculations with StarCD showing that the Nusselt number for heat transfer through the liquid neutron shield of the transfer cask was on the order of 8-10. The equitant Nusselt number corresponding to the k-effective model used in the SAR analyses is on the order of 20-25. In response to questions from TN regarding the basis of the calculation of the Nusselt number, PNNL responded that values were calculated on two different bases, to assure appropriate comparison between the StarCD results and the SAR model, and between COBRA-SFS calculations and the SAR model.

When using conduction through the liquid only, the StarCD heat transfer rates are can be quantified with Nusselt number values from 8-10. On this basis, the k-effective model used in the SAR analyses is equivalent to a Nusselt number on the order of 30-35. Including the effect of conduction through the steel support fins increases the conduction-only heat transfer slightly, which results in a slight difference in the value of the Nusselt number. On this basis, the StarCD heat transfer results yield Nusselt number values on the order of 6 to 9, and the k-effective model in the SAR is equivalent to a Nusselt number on the order of 20-25.

PNNL supported the Technical Monitor's conclusion that the non-conservatism of the k-effective model in SAR for heat transfer in the neutron shield does not result in temperatures that exceed regulatory limits. That is, confirmatory calculations with COBRA-SFS show that there is sufficient heat transfer through the neutron shield with a k-effective equivalent to a Nusselt number of 10 yields conservative results for the 32PTH1 DSC in the OS200 Transfer Cask. The peak clad temperature is below regulatory limit, even with a Nusselt number of 10. However, these confirmatory calculations show that the peak clad temperature values for some limiting configurations are higher than the values reported in the SAR.

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CONVERSATION RECORD (Continued)

SUMMARY

OS200 Transfer Cask (TC) Ç relationship to NUHOMS HD design

In response to TN's assertion that the modeling of the Nusselt number was not based on the HD submittal methodology, but rather supporting hand-calculations, PNNL inquired after the details of such a calculation. Natural convection within an enclosure between two concentric cylinders is a complex hydrodynamic and heat transfer problem, not readily amenable to analytical solution. TN committed to provide additional information on the basis of the Nusselt number and effective conductivity calculations used for this amendment application.

Regarding item III of the agenda, TN stated that the calculation of record for both the NUHOMS HD design and the Amendment 11 application is a hand calculation that the staff previously accepted. TN stated that the CFD calculation that was provided to the staff was provided to demonstrate that the hand calculation values were conservative bounding values. The staff stated that it did not understand how a hand calculation could be used to model the complex behavior of the liquid neutron shield. TN took the following action item associated with this item:

-TN will provide the licensing basis for the use of the hand calculation and the basis for their belief that the NRC has previously accepted this hand calculation (ACTION ITEM #1)

Regarding item IV of the agenda, the staff discussed the end result of their confirmatory calculations and informed TN that the results of the confirmatory calculations would be described in the staff's safety evaluation report associated with Amendment 11 to the Standardized NUHOMS design. The staff stated at the current time it believes that its current confirmatory calculations agree at a high-level with the results of TN's calculations. However, the staff stated that it believes the areas of non-conservatisms that are mentioned above would lead the staff toward a conclusion that TN's overall thermal methodology may not be appropriate for use in evaluating future changes to the Standardized NUHOMS design under 10 CFR 72.48. TN took the following action items associated with this issue:

-Consider whether the results of the staff's confirmatory calculations will be factored into the request for additional information (RAI) response for the Amendment 11 application. The RAIs were provided to TN in an August 29, 2007, letter (see ADAMS accession number ML072410348). (ACTION ITEM #2)

-Consider whether TN wishes to engage the staff more regarding the results of the confirmatory calculations to preclude the possibility that the staff will make a statement in the safety evaluation report that TN's thermal methodology is unacceptable for evaluating changes to the Standardized NUHOMS design in the future. (ACTION ITEM #3)

At the end of the phone call the staff and TN took the following actions:

-the staff will summarize the phone call and provide it on the docket and to TN (ACTION ITEM #4)

- the staff and TN will arrange another phone call after the 10/18/07 phone call summary is available to TN (ACTION ITEM #5)