

August 8, 2008

MEMORANDUM TO: Nader Mamish, Deputy Director
Licensing and Inspection Directorate
Division of Spent Fuel Storage and Transportation
Office of Nuclear Material Safety
and Safeguards

FROM: B. Jennifer Davis, Senior Project Manager **/RA/**
Licensing Branch
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Office of Nuclear Material Safety
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SUBJECT: SUMMARY OF JUNE 27, 2008 MEETING, WITH HOLTEC
INTERNATIONAL, TO DISCUSS NRC'S INFORMATION NEEDS
RELATED TO METAMIC HT FOR THE HOLTEC HI-STAR 180

PURPOSE:

For U.S. Nuclear Regulatory Commission (NRC) staff and Holtec International to discuss the extent of NRC's informational needs related to Metamic HT properties and structural modeling questions that resulted in NRC's suspending its review of Holtec's HI-STAR 180 application.

MEETING SUMMARY:

The meeting took place on June 27, 2008, from 10:00 a.m. to 4:00 p.m., at the NRC's Executive Boulevard Building in Rockville, MD. Attendees included Holtec staff and consultants, NRC's Division of Spent Fuel Storage and Transportation (SFST) staff, and several members of the public. An attendance list is enclosed (Enclosure 1). The meeting began with introductions, introductory remarks by SFST staff and Holtec staff, and then moved into a discussion of NRC's open technical issues (OTIs) in the materials and structural areas (see ML081650206 for the full list). Holtec then presented its plans for addressing the open technical issues, including both further materials characterization, and additional structural analyses. Holtec indicated in the meeting their intent to submit the revised HI-STAR 180 application in September; however, following the meeting, they may decide to revise this date.

NRC staff began the meeting with a discussion of Open Issues related to the Metamic HT structural materials data (Enclosure 2). Normally, when the materials engineering staff are performing their portion of the review, they are working with materials that have been fully characterized before their selection by the applicant. However, Metamic HT is a proprietary material, and characterization results are not readily available to support the staff design review. In addition, no similar materials could be identified that would indicate expected properties for Metamic HT (including conventional Metamic), and the usefulness of the open literature was limited. In essence, Metamic HT is a unique material, which limits staff's ability to predict its behavior during production and service. In conclusion, staff stated that they cannot make any findings about Metamic HT's adequacy for the proposed application. A comprehensive development program is necessary; a holistic approach to identifying just what Metamic HT can

do, and how it behaves. The comprehensive development program should cover the materials areas listed in the open technical issues; however, the list of OTIs sent with the NRC's letter of June 12, 2008, is not necessarily complete, due to the staff suspending its review.

Holtec staff then presented their position and proposed path forward to address SFST's concerns with respect to the HI-STAR 180 fuel basket material, Metamic HT (Enclosure 3). It is first important to note that Metamic HT is not an alloy. It is actually a dispersion-strengthened composite: alumina-reinforced aluminum (Al_2O_3 reinforced Al) with added boron carbide (B_4C); the final Metamic HT product is formed by extrusion. The structural properties depend on three variables: 1) surface area to mass ratio of the powder, 2) particle size of aluminum powder, and 3) temperature of extrusion.

Holtec's slides contain a summary of the NRC's OTIs as well as Holtec's plans to address the issues. Some of the issues discussed included:

- The Metamic HT test report, previously provided to SFST contains only limited test data (and not a full range of characterization tests).
- Holtec asserted that there is widespread use of aluminum *alloy* baskets in Europe and Japan.
- From slide 7, following discussion with NRC staff, Holtec agreed to delete the design life in the Safety Analysis Report (SAR). Currently, it is listed as 40 years; however, NRC staff pointed out that 10 CFR Part 71 limits the duration of an initial license to 5 years.
- Holtec asserted that Metamic HT is generally isotropic; they will test further to demonstrate the isotropy. Many of the NRC staff's open technical issues centered around the concern that the Metamic HT is anisotropic.
- The Arrhenius relation (Slide 34), used to predict long-term high-temperature behavior, needs to be further clarified (particularly the basis for the activation energy). The information in several of the following slides is based on the Arrhenius relation; it may need to be updated if the values in the relation are changed.
- The welds employed for portions of the basket construction are simply to hold the basket configuration; the welds are not structural. However, Holtec has committed to directly simulating all basket welds in the structural modeling.

NRC staff indicated that the materials issues are related to the lack of sufficient characterization to qualify Metamic HT as a structural material. In order for the NRC to make a regulatory decision, the basis must be supported and demonstrated. Further, the limited data the staff received was not accompanied by a sufficiently thorough data analysis.

Following the materials-related open technical issues discussion, one of Holtec's consultants presented a "Proposed Protocol for the Establishment of Critical Mechanical Properties of Metamic-HT" (Enclosure 4). The consultant presented a plan to quantify the physical characteristics of Metamic HT to resolve the open technical issues raised by the NRC staff. Key discussion points during this presentation included:

- Holtec plans to establish a baseline performance database through statistically valid sampling. They will test to nationally recognized recommended practices, and will use

appropriately certified testing laboratories. NRC staff indicated that the choice of both sampling protocol, and sample sizes, should be justified.

- Base metal coupons and welded coupons will be tested for the following “critical properties”: minimum yield strength, minimum Young’s modulus, minimum elongation, and minimum thermal conductivity, all over a range of temperatures.
- Standard protocols for acceptance testing of the material, and for rejection of plates that fail acceptance testing should be followed.
- Samples will also be tested for isotropy, and for change in neutron attenuation as a function of thermal aging. NRC staff indicated that there may be other, better ways to test for isotropy for the desired function, than that currently proposed.

The third Holtec presentation, “Weld Qualification Program for Metamic HT” (Enclosure 5), completed the materials issues portion of the discussion. Holtec intends to initiate weld procedure qualification well ahead of their normal practice in order to establish the reliability of Metamic HT welds.

Next, NRC staff presented an overview of the structural issues (Enclosure 6). There are two main issues, 1) finite element analysis (FEA) benchmarking using LS-DYNA, and 2) HI-STAR 180 FEA using LS-DYNA. Ultimately, NRC staff cannot determine the adequacy of the method used for benchmarking, given the information provided, and cannot determine if the HI-STAR 180 has been sufficiently characterized to perform its safety function from the perspective of structural behavior. These questions may also be applicable to other license applications or amendments currently under review, or for future review.

Finally, Holtec discussed its plans for addressing the structural OTIs (Enclosure 7). For each OTI, they plan to do one of three things – follow the path forward listed on the slide, provide a response, or request clarification. Note that as part of the path forward for OTI #2-1 (slide 2), Holtec stated that “FEA using LS-DYNA will be validated if all other structural open technical items (OTI) are resolved.” NRC staff indicated that this is the overarching issue with respect to benchmarking. For OTI #2-2, NRC staff pointed out that their concerns have to do with consistent application, not the methodology. There was quite a bit of discussion on OTI #2-3 with respect to use of tetrahedral elements (vs. hexahedral elements). The consensus was that use of tetrahedral elements has been known to cause problems, and should be avoided.

During the discussion, NRC staff stated that the key questions are 1) a need to validate the model for this and future designs (using existing and additional test data), 2) a need to make sure that the model considers the interaction of all components, and 3) a need to discuss gap analysis. For example, NRC pointed out that in actual testing the end drop test and center of gravity (CG) over corner were successful; however in the side drop test all eight bolts sheared off. An LS-DYNA simulation for those tests should get the same results, if it is properly done. In response, Holtec staff committed to do more testing, if necessary, and use existing (and new) data to validate the LS-DYNA code, and to expand the LS-DYNA benchmarking to the failed tests to see if it would accurately predict the results. In addition, Holtec committed to perform additional testing on Metamic-HT to further uphold the minimum guaranteed values provided in

the SAR. Continued discussion resulted in a commitment by both parties to hold a telecon to further discuss the benchmarking issues.

In closing, NRC management requested that if Holtec does resubmit the HI-STAR 180 application, they should make sure that the package is complete; it will be helpful to both organizations, and the review process will be much more efficient. In addition, it is important to note that the open technical issues do not necessarily comprise a complete list of what the staff needs. It is important that Holtec look at the application holistically to determine what it should contain. Holtec management stated its intent to request a meeting to describe the new submittal prior to actual submission. Finally, NRC management encouraged Holtec to choose the resubmittal date to accurately reflect the work that needs to be done prior to resubmittal.

The members of the public in attendance did not have any questions or comments.

No regulatory decisions were made at the meeting.

If you have any questions or comments, please contact Jennifer Davis at (301) 492-3371 or BJennifer.Davis@nrc.gov.

Docket No. 71-9325

TAC No. L24076

Enclosures:

As stated.

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DISTRIBUTION:

NRC attendees CStaab BBrach KGruss

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DATE:	08/07/2008		08/07/2008		08/07/2008	
	SFST					
NAME:	EBenner					
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June 27, 2008
ATTENDANCE LIST

<u>Name</u>	<u>Affiliation</u>
Bill Brach	NRC/SFST
Nader Mamish	NRC/SFST
Marissa Bailey	NRC/SFST
Eric Benner	NRC/SFST
Christopher Regan	NRC/SFST
Jennifer Davis	NRC/SFST
Geoff Hornseth	NRC/SFST
Jason Piotter	NRC/SFST
Gordan Bjorkman	NRC/SFST
Charles Interrante	NRC/SFST
Mathew Panicker	NRC/SFST
Mike Call	NRC/SFST
JoAnn Ireland	NRC/SFST
David Tang	NRC/SFST
Bob Tripathi	NRC/SFST
John Vera	NRC/SFST
Bob Einziger	NRC/SFST
Kim Hardin	NRC/SFST
Matthew Gordon	NRC/SFST
Elijah Dickson	NRC/SFST
Veronica Wilson	NRC/SFST
Zhian Lee	NRC/SFST
Neil Day	NRC/SFST
Ata Istar	NRC/SFST
Peter Lien	NRC/SFST
Bryce Lehman	NRC/SFST
Kris Singh	Holtec International
Luis Hinojosa	Holtec International
William Woodward	Holtec International
John Menhart	Holtec International
Richard Arn	Holtec International
Stefan Anton	Holtec International
Walter Rajner	NMD EmbH
Tom Haynes	Metamic LLC
Pierre-Alexandre Monsigny	NOK
Philip Blue	Self/Consultant to Holtec
John Hunter	Computer Powder
Don Shaw	Transnuclear, Inc.
Marlin Stoltz II	Transnuclear, Inc.
Joni Zielinski	Representative Jim Saxton
Maureen Conley	Platts/McGraw-Hill
Everett Redmond	NEI

ENCLOSURE 2:
METAMIC HT MATERIALS ISSUES
(NRC STAFF SLIDES)

ENCLOSURE 3:
HOLTEC'S POSITION AND PROPOSED PATH
FORWARD TO ADDRESS SFST'S CONCERNS WITH
RESPECT TO THE HI-STAR 180 FUEL BASKET
MATERIAL
(HOLTEC STAFF SLIDES)

ENCLOSURE 4:
PROPOSED PROTOCOL FOR THE ESTABLISHMENT
OF CRITICAL MECHANICAL PROPERTIES OF
METAMIC HT
HOLTEC CONSULTANT SLIDES

ENCLOSURE 5:
WELD QUALIFICATION PROGRAM FOR METAMIC HT
HOLTEC STAFF SLIDES

ENCLOSURE 6:
OVERVIEW OF STRUCTURAL ISSUES
NRC STAFF SLIDES

ENCLOSURE 7:
HI-STAR 180 STRUCTURAL OPEN TECHNICAL
ISSUES
HOLTEC STAFF SLIDES