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February 14, 2005

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

Subject: Dry Storage Cask Annulus Air Flow Regime

Reference: USNRC Docket No. 72-1014, TAC No. L23657
SFPO Meeting with Holtec International on 19 January 2005
Holtec Letter 5014544 from E. Rosenbaum, dated 21 October 2005

Dear Sir:

On 21 October 2004, we transmitted a topical report to the NRC. This topical report (Holtec Report HI-2043258r0) evaluated the results of an EPRI/INEL test program on an actual ventilated storage cask loaded with spent fuel. The purpose of this evaluation was to determine if the airflow through the annular cooling passages of the cask was turbulent or laminar. It is our conclusion that this airflow is turbulent and that it is appropriate to model the airflow in the HI-STORM 100 System as turbulent.

This topical report was discussed in a meeting between the Spent Fuel Project Office and Holtec International on 19 January 2005. During the meeting, the SFPO Staff requested that we perform several additional analyses to confirm the results presented in our topical report. Specifically, it was requested that the sensitivity of the model to the effective thermal conductivity of the MSB, the size of the inlet vents, and the computational mesh density be examined. We agreed to perform such sensitivity studies.

Preliminary results of the first sensitivity study, examining the impact of the MSB internals effective thermal conductivity assumption on the MSB surface temperature profile, were transmitted to the NRC on 1 February 2005. The second and third sensitivity studies, examining the impacts of the inlet vent size and the computational mesh density, have been completed. These inlet vent size study evaluated a 20% increase in the area of the inlet vents. The computational mesh density study evaluated a very large increase in the number of cells used in the model, including a 50% increase in the number of cells across the width of the air annulus. The vacuum condition (Run #6 from the EPRI/INEL tests) was used for these studies, as was suggested by the SFPO Staff in the January 19th meeting.

The calculations performed for the inlet vent size study indicate that a 20% increase in the size (i.e., flow area) of the VSC-17 inlet vents does not have a significant impact on the computed MSB shell temperatures. The calculations performed for the computational mesh density study indicate that a large increase in the number of computational cells, including a 50% increase in the number of radial cells across the air annulus, does not have a significant impact on the

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computed MSB shell temperatures. *Preliminary* results of these calculations are attached to this letter, in advance of their formal issuance in a future revision to the topical report, to allow the NRC to examine them as early as possible.

We are continuing our efforts to address the NRC's final request from the January 19th meeting, which was to identify the reason for our model's overprediction of the MSB shell temperatures by the as much as 15°C. We hope to have these efforts completed shortly and preliminary results will be transmitted to the NRC as soon as possible, again to allow the NRC to examine them as early as possible, and will also be added to the topical report in a future revision.

We would appreciate the SFPO's expeditious review of the attached technical material to allow us to reach a consensus on this topic as quickly as possible. Please feel free to contact me if any questions arise or if you require any additional information.

Sincerely,

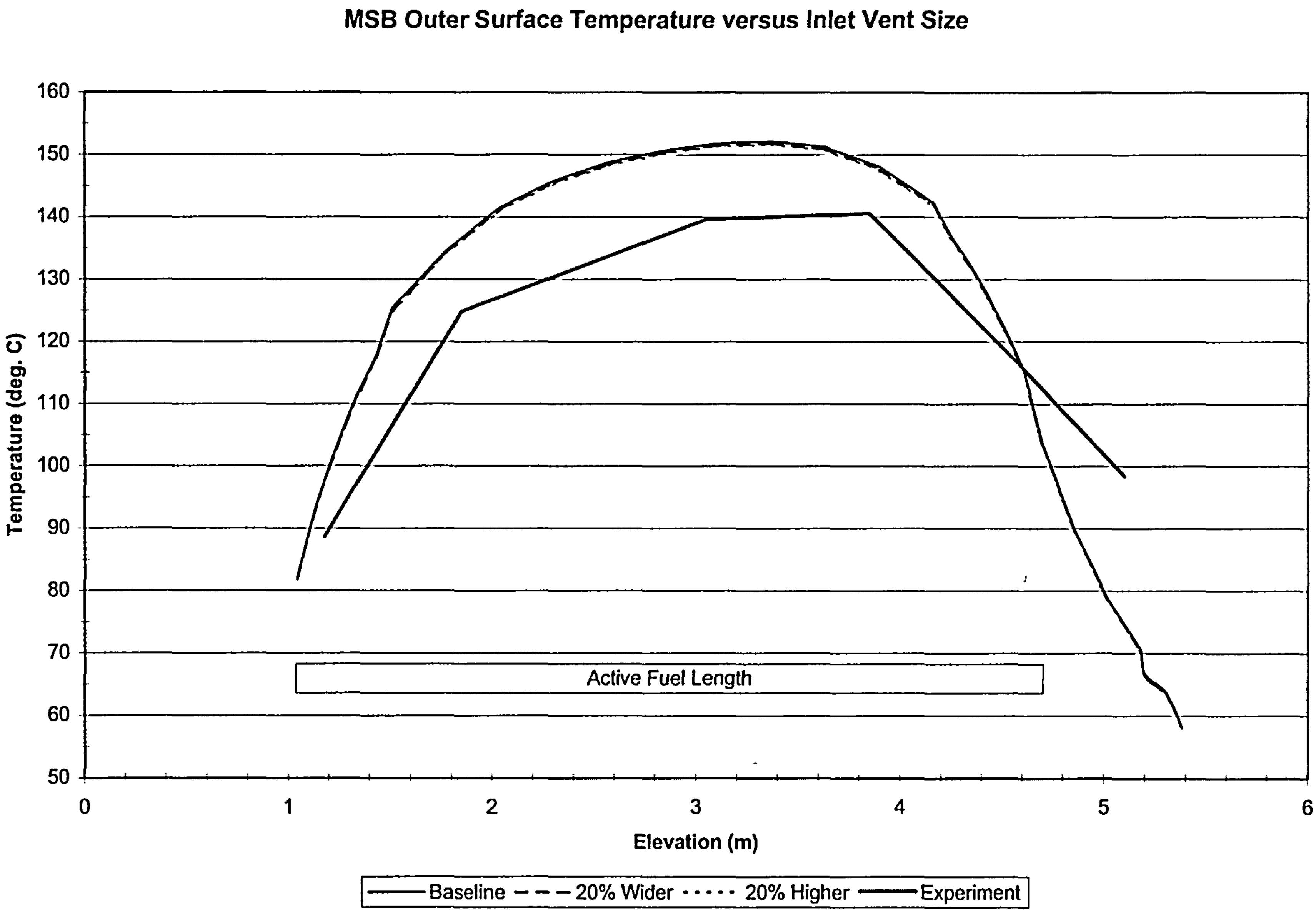
Evan Rosenbaum
Project Manager, LAR 1014-3

Technical Concurrence:

Dr. Debabrata Mitra-Majumdar
Principal Engineer

Attachment: Preliminary Inlet Vent Size Study Results (pages 1 and 2)
Preliminary Mesh Density Study Results (pages 3 and 4)

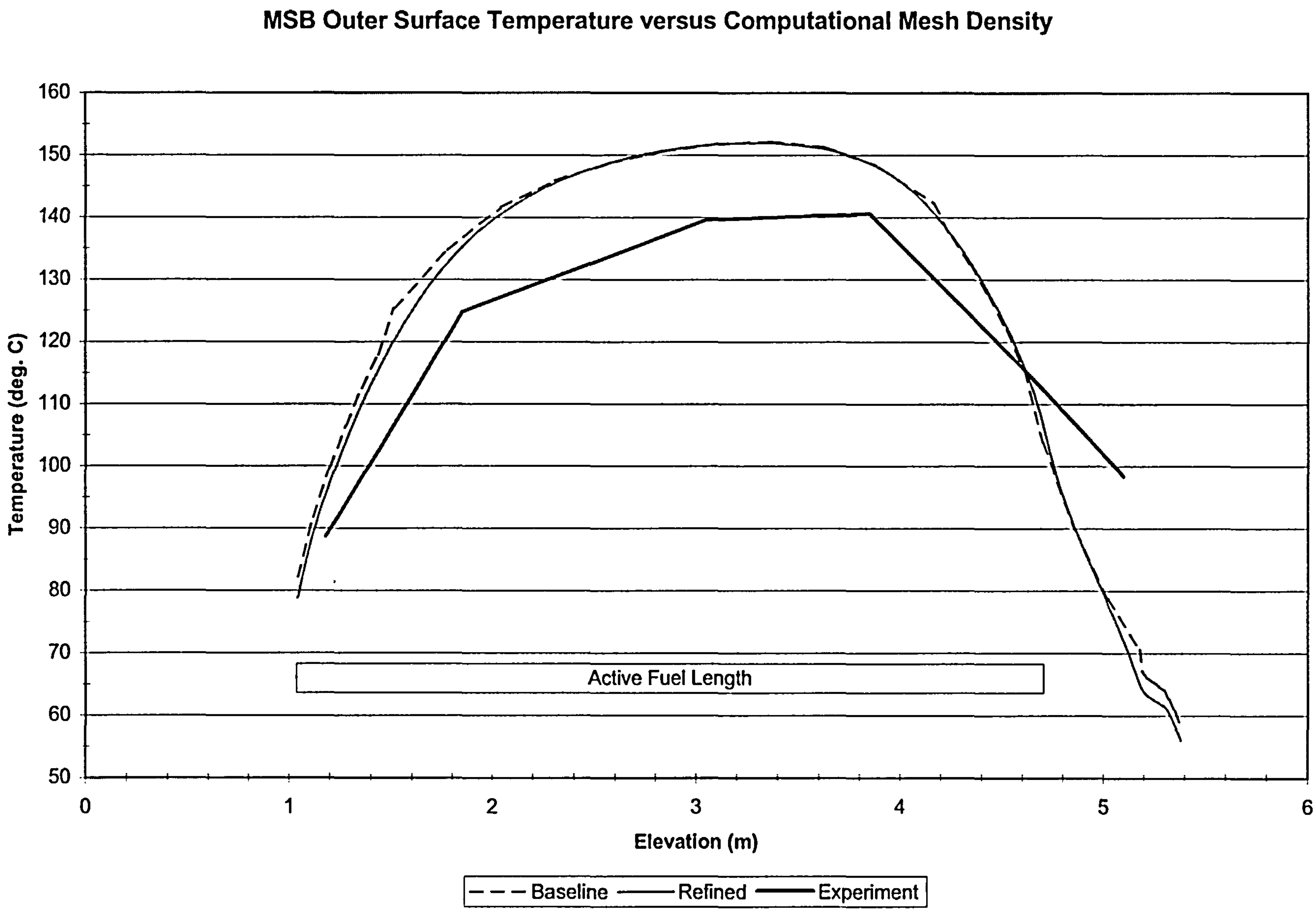
emcc: Mr. Larry Campbell, USNRC
Mr. Wayne Hodges, USNRC
Mr. John Monninger, USNRC
Mr. Christopher Regan, USNRC


MSB Outer Surface Temperature versus Inlet Vent Size
Temperature (deg. C)
160
150
140
130
120
110
100
90
80
70
60
50
Active Fuel Length
0
1
2
3
4
5
6
Elevation (m)
Baseline
20% Wider
20% Higher
Experiment

	Experimentally Measured Values (see Note 1)	FLUENT Computed Results		
		Baseline Run	Sensitivity Run 1 (+20% Width)	Sensitivity Run 2 (+20% Height)
Average Air Outlet Temperature (see Note 2)	66.0°C	65.8°C	65.5°C	65.3°C
Temperature of VSC-17 Side Surface at 5.1 m (see Note 3)	45.9°C	48.7°C	48.5°C	48.4°C
Maximum Weather Cover Temperature	52.8°C	49.9°C	49.7°C	49.7°C
Maximum Clad Temperature	384.1°C	319.1°C	318.7°C	318.6°C

Notes:

1. According to the EPRI report (TR-100305), the measurement uncertainty for the experimental values is +/- 4°C for clad temperature and +/- 4.5°C for all other temperatures reported in this table. Computed values agree with measured values within this level of accuracy.
2. The observed agreement between the measured and computed air temperatures indicates that the model is accurately predicting the air flow rate and heat transfer into the air stream.
3. The temperature at this elevation is compared because this is the elevation where the maximum measured side surface temperature occurs.
4. The first three rows of data account for the three heat transfer paths from the VSC-17 to the ambient (i.e., convection and radiation from cask top and side, and convection to flowing annulus air). These results indicate that that distribution of heat rejection among the three pathways predicted by the computer model agrees with experimental results.


MSB Outer Surface Temperature versus Computational Mesh Density
160
150
140
130
120
110
100
90
80
70
60
50
Temperature (deg. C)
Active Fuel Length
0
1
2
3
4
5
6
Elevation (m)
Baseline
Refined
Experiment

	Experimentally Measured Values (see Note 1)	FLUENT Computed Results	
		Baseline Run (~2000 cells)	Sensitivity Run (~200,000 cells)
Average Air Outlet Temperature (see Note 2)	66.0°C	65.8°C	65.8°C
Temperature of VSC-17 Side Surface at 5.1 m (see Note 3)	45.9°C	48.7°C	44.2°C
Maximum Weather Cover Temperature	52.8°C	49.9°C	49.3°C
Maximum Clad Temperature	384.1°C	319.1°C	331.3°C

Notes:

1. According to the EPRI report (TR-100305), the measurement uncertainty for the experimental values is +/- 4°C for clad temperature and +/- 4.5°C for all other temperatures reported in this table. Computed values agree with measured values within this level of accuracy.
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4. The first three rows of data account for the three heat transfer paths from the VSC-17 to the ambient (i.e., convection and radiation from cask top and side, and convection to flowing annulus air). These results indicate that that distribution of heat rejection among the three pathways predicted by the computer model agrees with experimental results.