

## **Additional Information for the Condition (1) of LBLOCA SER**

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The NRC staff could not confirm the applicant's response during the January 2016 Audit Meeting. Therefore, the NRC staff imposes Condition (1) on the use of CAREM:

*Should changes to the APR1400 configuration, evaluation model, or design input result in large break LOCA flooding rates lower than 10 cm/sec, the CAREM analyses shall require additional justification and NRC approval.*

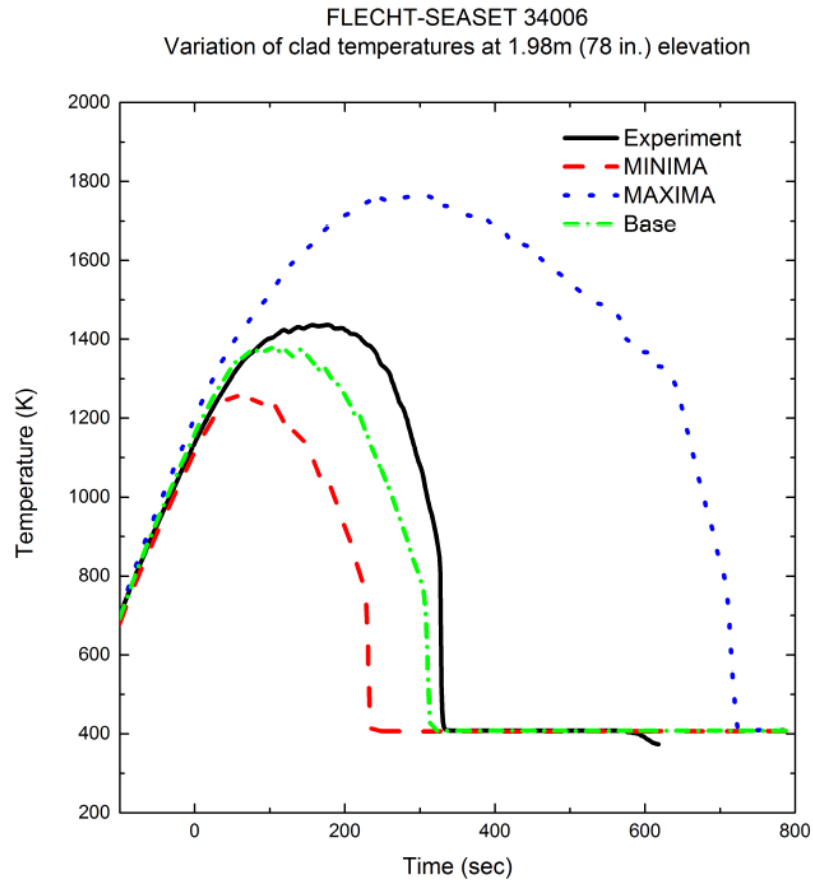
<KHNP additional information>

The phrase of condition (1) need to be deleted or modified because of the following reasons:

CAREM follows best-estimate with uncertainty propagation approach.

- For each code assessment against test data, the calculated cladding temperature of the base case calculation does not need to cover the maximum measured data based on the best-estimate approach.
- The purpose of base case calculation is to confirm the general thermal-hydraulic behaviors and the code predictability (or code accuracy) by evaluating PCT difference between calculated and measured values.
- The code accuracy obtained from base case calculation is used to estimate the degree of uncertainties.
- On the other hand, the 3<sup>rd</sup> highest PCT of SRS calculation is checked whether the selected uncertainty parameters and their ranges can cover the maximum measured PCT or not in the Experimental Data Covering (EDC) step of CAREM.

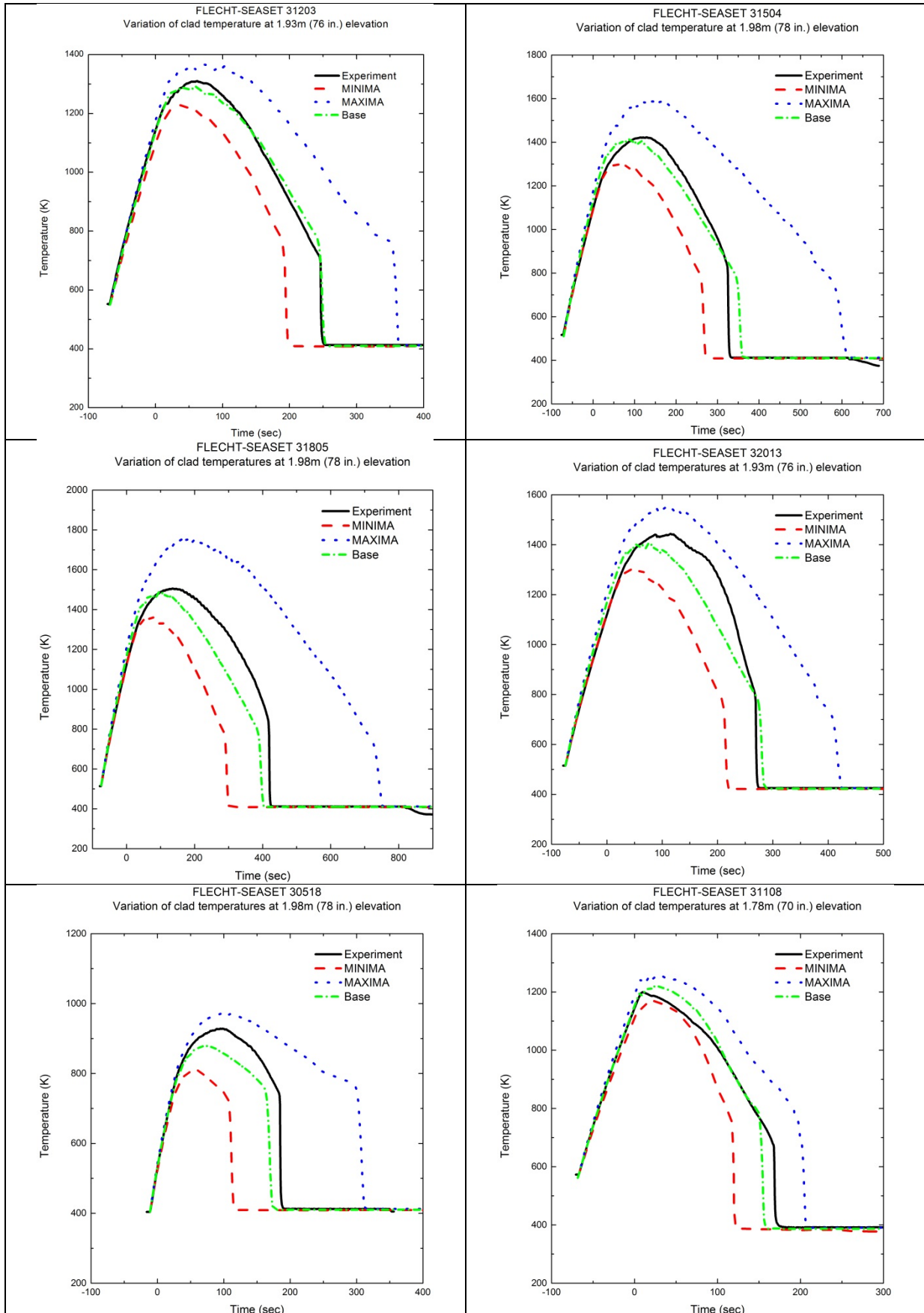
For example: Test 34006 (Flooding rate of 1.5 cm/sec)



- Based on the best-estimate with uncertainty propagation approach, if the 3<sup>rd</sup> PCT can cover the maximum measured PCT, it concluded that selected uncertainty parameters and their ranges are appropriate.
- The other assessment results for low flooding rate tests show that calculation results by best-estimate with uncertainty propagation approach can cover the maximum measured PCTs as shown in below:

FLECHT-SEASET Test Number	Flooding Rate (cm/sec)
31203	3.84
31504	2.46
31805	2.1
32013	2.64
30518	3.89
31108	7.9

# Calculation results by best-estimate with uncertainty propagation approach



- Consequently, although some of base calculation results for FLECHT-SEASET underestimate the maximum measured PCTs, it can conclude that best-estimated code results with uncertainty propagation have conservatism because the 3<sup>rd</sup> highest PCTs for all 17 test cases cover the maximum measured PCTs.

Code assessment results for low flooding rate tests show that the best-estimate with uncertainty propagation approach of CAREM has sufficient conservatism to predict PCT.