Simulations of the CCI tests of the OECD-MCCI Project:
An attempt to model the heat conduction in concrete during CCI

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An attempt to model heat conduction in concrete at CCI by the CORCON code , as a part of the integral code MELCOR 1.8.5, has been made.
Concrete has very low thermal conductivity and that is why the majority of the MCCI codes, including CORCON, do not model the heat conduction in concrete. Yet, at an accident, the amount of relatively cold mass of cavity concrete is big and there is a potential to remove at least some energy from the melt via conduction. Also, this could be the reason why none of the calculations from the analytical exercise on the CCI-2 experiment (part of experimental activities of the OECD-MCCI project), using all various codes, was able to predict the initial phase of the CCI-2 experiment (approximately first 60 minutes). At the very beginning of the test, a lot of heat could be removed via transient conduction and the melt would be then quickly encrusted at the lateral and bottom sides. Only remelting of a substantial thickness of this early crust enables to reach the quasi-steady ablation, i.e. the state which the MCCI codes are able to model.
To assess the impact of this phenomenon we utilized the capabilities of the MELCOR code trying to get a rough estimate of the amount of energy transfered from the pool by conduction in concrete in the course of CCI. The evaluation of this by MELCOR (as a CORCON driver) is parallel to the CORCON calculation, using some “external” heat structures which retain in time similar characteristics as the ablated concrete cavity walls. The MELCOR Heat Structure (HS) and Control Function (CF) Packages can be used for this. Boundary conditions for the conduction calculations are taken directly from CORCON and the calculated energy sink is being reported back to CORCON. Some manipulations on the input to the HS and CF (and also other packages) are needed, allowing the code to conduct heat through about the right thickness of concrete of various shapes in the course of running CCI (with the changing cavity geometry).

First results of the calculations for the CCI-2 test indicate that CORCON in MELCOR (with all the MELCOR flexibility) is able to simulate some aspects of the dry CCI taking into account the heat conduction in concrete. This capability of CORCON in MELCOR could be used for the plant CCI calculations to assess roughly the potential impact of the heat conduction on the overall energy balances.