ABSTRACT

These simulations of the fire behavior of a typical room of a hotel were made. A benchmark with a high-scale test was prepared by the CENRI Fire Research Group (CDB immane). The main goal was to verify the accuracy of the predictions of various models of fire behavior in functions of the modelling decisions taken by the various authors. For this purpose, a number of questions were to be answered. The most important of these was the thermal data of the fire and the best fitting of the various models to these data. In the study, the main model, CFAST V.6.0, the fit model, FDS V.5.0, and the simplified and adjusted model of Thomas and Mc Puff were used. It is the case of the quality of the results obtained depends on the input data. The input data were obtained from three different sources: the literature, the data base of others, and the preliminary results of the experiments. The results were compared to the experimental results. The CFAST model reproduced very well the experimental temperature and the HRR, however the fire source has not been modelled. FDS reproduced very well the experimental temperature, but the HRR was underestimated. In general, the analysis of the results shows that the CFAST model is the most appropriate for the simulation of fires in such environments.

1. PRESENTATION OF THE BENCHMARK

A. Description of the room

The heat release after the flash-over is 4031 kW. It remains as a steady value during the whole fire. The heat release rate is controlled by the rate of decomposition of the available solid fuel and the temperature of the hot layer.

B. Material characterisation

The characteristics of the materials involved in the test were unknown. Those characteristics have been estimated from experience and LNE database, and adjusted to fit with the experience.

2. SIMPLIFIED MODEL, ANALYTICAL APPROACH

A. Before the Flash-Over

The Heat Release Rate (HRR) is given by the equation: Q = ΔH / m, where ΔH is the heat of combustion and m is the mass of the fuel.

B. Post Flash-Over

The heat release rate is controlled by the rate of decomposition of the available solid fuel and the temperature of the hot layer.

3. SIMULATION BASED ON ZONE MODEL : CFAST V. 6.0

The CFAST model is used to simulate the fire in the room. The thermal data of the fire and the best fitting of the various models to these data are obtained.

5. COMPARISON OF RESULTS

Two comparisons are carried out: global heat release rate (Figure 13), calculated by the three models (field, zone, analytic) vs experiment, and mean temperature of the hot layer (Figure 16), calculated by the three models vs experiment.

6. CONCLUSIONS AND PERSPECTIVES

The CFAST simulation predicted a good behavior of the thermal data near to the measurements. However, the FDS simulation shows a very good correspondence with the experimental curve until about 1000 s after the start of the fire. Beyond that time, an important divergence appears. It is the case of the very low fraction of fire risk in the simulation (low heat release). This research could be continued and improved by adjusting the thermal parameters of the materials considered for the simulations. Doing so, the divergence between the curves could be reduced.