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*Published in:*  
Indoor Air 2008

*Publication date:*  
2008

*Document Version*  
Publisher's PDF, also known as Version of record

[Link to publication from Aalborg University](#)

*Citation for published version (APA):*  
Nielsen, P. V., Brohus, H., Petersen, A. J., & Sommerlund-Thorsen, K. (2008). Smoke Movement in an Atrium with a Fire with Low Rate of Heat Release. In *Indoor Air 2008: The 11th International Conference on Indoor Air Quality and Climate, 17th August to 22nd August 2008* Technical University of Denmark (DTU).

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# Smoke Movement in an Atrium with a Fire with Low Rate of Heat Release

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## 1 Introduction

The smoke movement from a fire normally reaches the ceiling in an atrium due to the buoyancy effect on the smoke. A vertical temperature gradient can exist in an atrium, and the fire may have such a low rate of heat release that the smoke is not able to reach the ceiling region because of the temperature gradient in the atrium.

## 2 Methods

The situation is studied by smoke experiments carried out in a small-scale model and with numerical predictions made by the CFD program FDS.

## 3. Results

The following three figures address the different situations, and figure 2 shows the situation with stratification in the middle of the room.

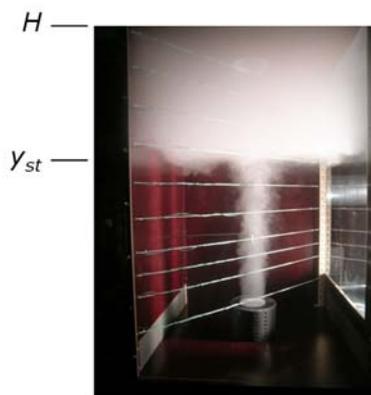


Figure 1. Smoke movement in a scale model with a high rate of heat release and active smoke ventilation. It is shown that the smoke layer is located in an upper zone above the height  $y_{st}$ . This height is a function of the smoke ventilation air flow and the heat release of the fire.

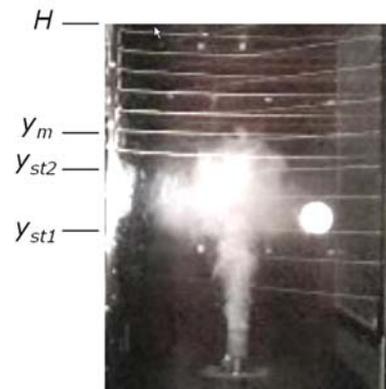


Figure 2. Smoke movement in a room with a vertical temperature gradient and a low rate of heat release. The smoke ventilation is inactive. The lower part of the atrium will be filled with smoke until the smoke ventilation starts.

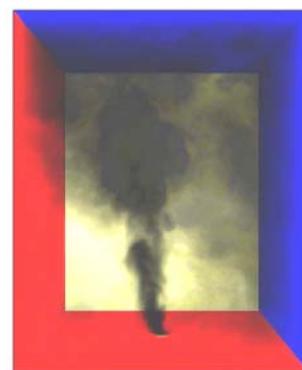


Figure 3. Smoke movement in a room with cold (upper and right), and warm (left and lower) surfaces. The heat release from the smoke is small, but turbulence in the room air flow removes the stratification which normally exists under the given conditions. This situation may often reflect the situations in practice.