It has been determined by Sandia National Laboratories and the US Nuclear Regulatory Commission that the use of deterministic, multi-room, zone-type fire modeling technology could enhance the reliability of their recent reactor safety risk studies.

These studies are confined to the relatively early detection times of fire development when fire-driven ceiling jets and gas-to-ceiling convective heat transfer are expected to play a particulary important role in room-to-room smoke spread and in the response of near-ceiling mounted detection hardware.

A parameter of concern in these risk analyses is the location of the fire within the space of fire origin. One goal of the analyses is to determine the significance to risk of this fire-position parameter.

This work presents a model to predict the instantaneous rate of convective heat transfer from fire plume gases to the overhead ceiling surface in a room of fire origin. The room is assumed to be at rectangular parallelopiped and, at times of interest, ceiling temperatures are simulated as being uniform.

Also presented is an estimate of the convective heat transfer, due to ceiling-jet-driven wall flows, to both the upper and lower portions of the walls. The effect on the heat transfer of the location of the fire within the room is taken into account. Finally presented is a model of the velocity and temperature distributions in the ceiling jet.

The model equations were used to develope an algorithm and associated modular computer subroutine to carry out the indicated heat transfer calculations. The subroutine is written in FORTRAN 77 and called CEILHT. The algorithm and subroutine are suitable for use in two-layer zone-type compartment fire model computer codes.