Computer Models For Fire and Smoke

Model Name: JET

Version: 1.0

Classification: Zone Fire Model

Very Short Description: JET is a single compartment zone model for use in spaces where the lower layer remains close to ambient temperature and the fire is not ventilation limited. The model provides temperature predictions for the plume, ceiling jet, upper layer and ceiling as well as the upper layer depth. Activation of ceiling mounted fusible links and the impact of link activated ceiling vents, forced ventilation and draft curtains on the upper layer, ceiling jet, and link activation are included in the model.

Modeler(s), Organization(s): William D. Davis, National Institute of Standards and Technology, Gaithersburg Maryland, USA.

User's Guide: The Zone Fire Model JET: A Model for the Prediction of Detector Activation and Gas Temperature in the Presence of a Smoke Layer, National Institute of Standards and Technology, NISTIR 6324, (1999).

Technical References: The Zone Fire Model JET: A Model for the Prediction of Detector Activation and Gas Temperature in the Presence of a Smoke Layer, National Institute of Standards and Technology, NISTIR 6324, (1999).

Validation References: The Zone Fire Model JET: A Model for the Prediction of Detector Activation and Gas Temperature in the Presence of a Smoke Layer, National Institute of Standards and Technology, NISTIR 6324, (1999).

Availability: JET may be obtained from the NIST/BFRL web site http://fire.nist.gov/. The software and documentation is found under the selection Fire Modeling Software Online.

Price: free

Necessary Hardware: JET runs in Windows 95/98/2000 or Windows NT Workstation 4.0 or later. A 486DX/66 MHz or higher processor (Pentium166-MHz or higher is recommended. A minimum of 32 MB of RAM, a VGA or higher-resolution screen supported by Windows and a mouse is required.

Computer Language: JET is written in FORTRAN 77 with the interface written in VISUAL BASIC 4.0.

Size: Program requires a minimum of 32 MB of RAM and will reside on 4 MB of disk space once it is unzipped.

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Detailed Description:

JET is a two-zone compartment fire model that solves the conservation equations for mass and energy to obtain upper layer temperature and layer height. Convective losses to the ceiling from the ceiling jet and radiation losses from the fire are used to calculate the ceiling temperature as a function of distance from the plume centerline. Correlations that are sensitive to upper layer temperature and depth provide plume centerline ceiling temperature and maximum ceiling jet temperature and velocity as a function of radius.

The compartment geometry can be represented using a series of draft curtains and walls. A one-room compartment with a door may be modeled using a single draft curtain equal in length to the width of the door. Gas flows from the upper layer can exit either under the draft curtains, through ceiling vents, or with forced ventilation. The forced ventilation option allows gas flows to enter or exit the compartment.

Fusible links are used to control the opening of the ceiling vents. The heating of fusible links includes a balance between the convective heating of the link in the ceiling jet and the conductive cooling of the link as heat flows from the link to the supporting structure.

Applications that are appropriate for JET include:

a. Determination of activation times for fusible links controlling vents and sprinklers in compartments bounded by walls, draft curtains, or combinations of walls and draft curtains for user defined fire sizes and growth rates. Compartments with one or more sides unbounded may be modeled.

b. Determination of the impact of draft curtains, ceiling vents and forced ventilation on the depth of the smoke layer and the activation of fusible links.

c. Determination of the ceiling temperature as a function of upper layer depth and temperature and radial distance from the plume centerline with or without ceiling vents and forced ventilation.

d. Determination of maximum ceiling jet temperature and ceiling jet velocity as a function of upper layer depth and radial distance from the plume centerline with or without ceiling vents and forced ventilation.