Computer Models
For
Fire and Smoke

Model Name:	FIERAsystem
Version:	0.1
Classification:	Risk Assessment Model
Very Short Description:	FIERAsystem can be used to evaluate the performance of fire protection systems in light-industrial buildings, to evaluate compliance with established fire safety objectives and to determine the expected risk to life of occupants of these buildings. In addition, FIERAsystem calculates the expected fire costs in these buildings hence allowing the selection of cost effective designs. The various submodels of FIERAsystem can also be used independently to perform calculations, such as fire development in a compartment, smoke movement from the compartment of fire origin to other compartments in the building, structural response to fire attack and occupant response.
Modeler(s), Organization(s):	George Hadjisophocleous, Noureddine Benichou, Irene Reid and Joe Hum, National Research Council of Canada
User's Guide:	FIERAsystem User's Manual (NRC internal report in preparation)
Technical References:	Hadjisophocleous, G.V., Torvi, D.A., FIERAsystem Theory Report: System Model, Submitted to: *Internal Report, Institute for Research in Construction, National Research Council Canada,* 783, (IRC-IR-783) Torvi, D.A., Raboud, D.W., Hadjisophocleous, G.V.,, FIERAsystem Theory Report: Enclosed Pool Fire Development Model, Submitted to: *Internal Report, Institute for Research in Construction, National Research Council Canada,* 784, (IRC-IR-784) Torvi, D.A., Raboud, D.W., Hadjisophocleous, G.V.,,

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Hadjisophocleous, G.V., Feng, P., FIERAsystem Theory Report: Fire Department Response Model, Submitted to: *Internal Report, Institute for Research in Construction, National Research Council Canada,* 797, (IRC-IR-797)

Hadjisophocleous, G.V., Torvi, D.A., Yager, B.L., FIERAsystem Theory Report: Fire Department Effectiveness Model, Submitted to: *Internal Report, Institute for Research in Construction, National Research Council Canada,* 798, (IRC-IR-798)

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Validation References:	Fu, Z., Hadjisophocleous, G.V.,, "Two-zone fire growth and smoke movement model for multi- compartment buildings," Submitted to: *Fire Safety Journal*, pp. 1-30, Hadjisophocleous, G.V., Fu, Z., "Modeling smoke conditions in large compartments equipped with mechanical smoke exhaust using a two-zone model," *International Journal on Engineering Performance-Based Fire Codes*, 1, (3), pp. 162-167, 1999
Availability:	Within 2 years
Price:	Unknown
Necessary Hardware:	32 bits Windows, 95, 98, 2000 and NT
Computer Language:	Visual Basic 6
Size:	Approximately 50 MB of disk space and 32 MB of RAM required
Contact Information:	George Hadjisophocleous, 613-993-4757, George.hadjisophocleous@nrc.ca

Detailed Description:

FIERAsystem, (**Fi**re **E**valuation and **R**isk **A**ssessment) is fire risk assessment model for evaluating the risk from fires in light industrial buildings, such as warehouses and aircraft hangars. The model uses deterministic calculations of selected fire scenarios to evaluate fire development, smoke and fire spread through a building and occupant response and evacuation. The behaviour of the building elements to the fire attack is considered to determine times of fire spread from the fire compartment to the adjacent compartments. Also, fire department response and effectiveness, as well as reliability and effectiveness of the different active fire protection systems including detectors and automatic suppression systems are considered in the analysis.

Following the deterministic calculations, the model calculates time dependent probabilities of death based on the conditions in each compartment. Parameters considered for these probabilities include thermal radiation heat flux, concentration of toxic gases and temperature of hot gases in the compartment, all of which are computed deterministically by the FIERAsystem submodels. The probabilities of death are then used to determine the number of people that may die using the residual population, which is computed by the occupant response and evacuation models.

FIERAsystem also calculates the expected fire losses for each scenario based on the type of contents and their sensitivity to fire, smoke and water and the heat fluxes and smoke

concentrations in each compartment. Knowing the expected losses for each scenario and the life risk, enables the selection of cost-effective fire safety designs.

In addition to evaluating the risk from fires, the model can also be used to determine compliance with established objectives based on criteria selected by the model users. This feature makes FIERASystem a particularly useful tool for fire protection designers working in a performance-based code environment.