NISTIR 89-4081

# Fire Research Publications, 1988

Nora H. Jason

U.S. DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
(Formerly National Bureau of Standards)
National Engineering Laboratory
Center for Fire Research
Gaithersburg, MD 20899

May 1989

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National Bureau of Standards became the National Institute of Standards and Technology on August 23, 1988, when the Omnibus Trade and Competitiveness Act was signed. NIST retains all NBS functions. Its new programs will encourage improved use of technology by U.S. industry.

**U.S. DEPARTMENT OF COMMERCE**
**Robert Mosbacher, Secretary**
**NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY**
**Raymond G. Kammer, Acting Director**

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## ABSTRACT

"Fire Research Publications, 1988" is a supplement to previous editions; the last five editions are referenced below. Earlier edition information is available upon request.

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| 1983 | NBSIR 84-2871 | PB84-217066 |
| 1984 | NBSIR 85-3153 | PB85-208502 |
| 1985 | NBSIR 86-3372 | PB86-208317 |
| 1986 | NBSIR 87-3555 | PB88-109889 |
| 1987 | NBSIR 88-3758 | PB88-199641 |

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This year a new index has been added, the Keyword Index. If there is a keyword of interest to you, you may locate the complete reference by locating the first author. If more than one author is listed in this Index, it indicates additional references for this keyword. Following each reference, the keywords used to describe the entire document are noted.

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Atreya, A.

Atreya, A.; Wichman, I. S.; Tzeng, L. S.; Abu-Zaid, M.
Effect of Water on Piloted Ignition of Cellulosic Materials.
Annual Progress Report.
NIST-GCR-88-552, 45 pp. October 1988.
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PB89-127732
NIST-GRANT-60NANB5D0578
cellulosic materials; ignition; pilot flame

Babrauskas, V.

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SFPE Handbook of Fire Protection Engineering. 1st Edition.
Section 2. Chapter 1, National Fire Protection Assoc., Quincy, MA, 2/1-15 pp, 1988.
burning rate; pool fires; cribs; wood; upholstered furniture; mattresses; pillows; televisions; curtains; cable trays

Babrauskas, V.
Effective Measurement Techniques for Heat, Smoke, and Toxic Fire Gases.
QMC Fire and Materials Centre in association with Fire Research Station. Fire: Control the Heat...Reduce the Hazard. International Conference. October 24-25, 1988, London, England, 4/1-10 pp, 1988.
fire hazards; fire gases; toxic gases; smoke; toxicity

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Flammability of Upholstered Furniture with Flaming Sources.
European Conference on Furniture Flammability, 1st. November 2-3, 1988, London, England, 21 pp, 1988.
furniture; flammability tests; upholstered furniture; burners; cone calorimeters; furniture calorimeters; heat release rate

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cone calorimeters; polymethylmethacrylate; smoke; soot; plastics; upholstered furniture

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NBS SP 749, 92 pp. July 1988.
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flame retardants; cone calorimeters; furniture calorimeters; chromatography; plastics; heat release rate; compartment fires; fire tests; smoke production

Baum, H. R.
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Radiative Ignition of Solid Fuels in a Microgravity Environment--The Preheating Problem.
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microgravity; solid fuels; heating; ignition

Braun, E.

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toxicity; cotton; fire tests; large scale fire tests; polyurethane; small scale fire tests; upholstery; animals

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composite materials; cone calorimeters; extinction; fiberglass resins; flammability; heat release rate; ignition; resins; smoke; thermal decomposition

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Hazard I--Results of a User Evaluation of the Prototype Software.
NISTIR 88-3878, 32 pp. November 1988.
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computer programs; computer models; evaluation; fire models

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fire suppression; water sprays; well fires; blowout fires; extinguishment

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NISTIR 88-3888, 226 pp. November 1988.
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fire research; cellulose; charring; combustion; fire models; flame spread; ignition; polymers; smoke; soot; toxicity

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Cooper, L. Y.
Estimating the Environment and the Response of Sprinkler Links in Compartment Fires With Draft Curtains and Fusible Link-Actuated Ceiling Vents. Part 1. Theory.
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PB88-215462
sprinklers; building fires; compartment fires; computer models; algorithms; mathematical models; vents; sprinkler response; zone models

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flame spread; solid fuels; velocity

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smoke detectors; standards; tests; false alarms

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crude oil; combustion; thermal conductivity; ignition

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crude oil; ignition testing; oil spills; water

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Ceiling Jet Flows.
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ceiling jets; ceilings; fire growth

Evans, D. D.
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Combustion Institute/Eastern States Section. Chemical and Physical Processes in Combustion. 1988 Technical Meeting. December 5-7, 1988, Clearwater Beach, FL, D/1-6 pp, 1988.
fire suppression; water; sprinkler systems; fire fighting; drop sizes

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Environment Effects of Oil Spill Combustion.
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Flynn, J. H.; Levin, D. M.
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Thermochimica Acta, Vol. 126, 93-100, 1988.
thermal conductivity; differential scanning; calorimetry; heat transmission

Gann, R. G.
Gann, R. G.; Harris, R. H., Jr.; Krasny, J. F.; Levine, R. S.; Mitler, H. E.; Ohlemiller, T. J.
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cigarettes; upholstered furniture

Gann, R. G.; McGibeny, M. D.
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cigarettes; death; upholstered furniture; mattresses

Gore, J. P.
Gore, J. P.; Evans, D. D.; McCaffrey, B. J.
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Combustion Institute/Eastern States Section. Chemical and Physical Processes in Combustion. 1988 Technical Meeting. December 5-7, 1988, Clearwater Beach, FL, 60/1-4 pp, 1988.
fire suppression; water; temperature; flame radiation; jet flames; turbulent flames; blowout flames

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Journal of Fire Sciences, Vol. 6, No. 1, 61-79, January/February 1988.
hydrogen chloride; atmospheres; combustion; air

Gross, D.

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Measurements of Flame Lengths Under Ceilings.
NISTIR 88-3835, 29 pp. August 1988.
PB89-107734
flame research; fire plumes; flame height; gas burners; luminous flames; ceilings; crib fires; walls

Gross, D.; Davis, W. D.
Burning Characteristics of Combat Ship Compartments and Vertical Fire Spread.
NISTIR 88-3897, 29 pp. December 1988.
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PB89-141113
computer models; autoignition; fire spread

Harkleroad, M. F.

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Ignition and Flame Spread Measurements of Aircraft Lining Materials.
NBSIR 88-3773, 63 pp. May 1988.
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flame spread; ignition; aircraft interiors; material properties

Inaba, A.

Inaba, A.; Kashiwagi, T.; Brown, J. E.
Effects of Initial Molecular Weight on Thermal Degradation of Poly(methyl methacrylate). Part 1. Model 1.
Polymer Degradation and Stability, Vol. 21, 1-20, 1988.
plastics; polymethylmethacrylate; molecular weight; thermal degradation

Ito, A.

Ito, A.; Kashiwagi, T.
Characterization of Flame Spread Over PMMA Using Holographic Interferometry Sample Orientation Effects.
Combustion and Flame, Vol. 71, 189-204, 1988, and
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and U.S./Japan Government Cooperative Program on Natural Resources (UJNR). Fire Research and Safety. 9th Joint Panel Meeting of the UJNR. Norwood, MA. May 4-8, 1987,

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PB88-215926
flame spread; characterization; polymethylmethacrylate; holographic interferometry; building fires; floors; walls; interior furnishings; fire growth; temperature distributions; heat flux

Jackson, J. L.
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NISTIR 88-3809, 38 pp. October 1988.
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plastics; burning rate; charring; polymethylmethacrylate; pyrolysis; solid fuels; thermal properties

Jaluria, Y.
Jaluria, Y.; Kapoor, K.
Importance of Wall Flows at the Early Stages of Fire Growth in the Mathematical Modeling of Enclosure Fires.
Combustion Science and Technology, Vol. 59, No. 4-6, 355-369, 1988.
mathematical models; fire growth; enclosures; walls; compartment fires

Jason, N. H.
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Fire Research Publications, 1987.
NBSIR 88-3758, 70 pp. April 1988.
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PB88-199641
fire research; fire models; bibliographies; fire tests; combustion toxicology; smoke; soot

Jason, N. H.
Spacecraft Fire Detection and Extinguishment: A Bibliography.
NBSIR 88-3712, 65 pp. February 1988.
Available from National Technical Information Services
PB88-178553
fire detection; spacecraft; aircraft; bibliographies; fire suppression; fire extinguishment; ships; submarines; fabric flammability

Jason, N. H.; Houston, B. A., Editors
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NBSIR 88-3753, April 1988.
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Norwood, MA, 547 pp, 1988.
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fire research; fire safety

Jones, W. W.
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Impact of "Stack Effect" on the Flow Field in a Compartment in a High Rise Building.
Combustion Institute/Eastern States Section. Chemical and Physical Processes in Combustion. 1988 Technical Meeting.
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ventilation; high rise buildings; flow field; compartments; stack effect; model fires

Kapoor, K.
Kapoor, K.; Jaluria, Y.
Heat Transfer From a Negatively Buoyant Wall Jet. Annual Report.
NBS-GCR-88-541, 45 pp. February 1988.
Available from National Technical Information Services
PB88-181953
NBS-GRANT-NB83NADA4047
heat transfer; compartment fires; convective heat transfer; enclosure fires; fire plumes; fire modeling; room fires; walls

Kashiwagi, T.
Kashiwagi, T.; Omori, A.
Effects of Molecular Weight and Thermal Stability on Polymer Gasification.
Combustion Institute/Eastern States Section. Chemical and Physical Processes in Combustion. 1988 Technical Meeting.
December 5-7, 1988, Clearwater Beach, FL, 68/1-4 pp, 1988.
plastics; molecular weight; thermal stability; gasification; flammability

Khoudja, N.
Khoudja, N.
Procedures for Quantitative Sensitivity and Performance Validation Studies of a Deterministic Fire Safety Model.
NBS-GCR-88-544, 153 pp. March 1988.
Available from National Technical Information Services
PB88-180195
fire models; fire safety; validation; quantitative analysis; sensitivity analysis; computers

Klote, J. H.
Klote, J. H.
Analysis of the Influence of Piston Effect on Elevator Smoke Control.
NBSIR 88-3751, 24 pp. April 1988.

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smoke control; elevators (lifts); hazard analysis; piston effect; pressurization; smoke

Klote, J. H.
Computer Model of Smoke Movement by Air Conditioning Systems (SMACS).
Fire Technology, Vol. 24, No. 4, 299-311, November 1988, and
NBSIR 87-3657, 24 pp. November 1987.
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PB88-159462
air conditioning; air movement; computer models; ducts; fans; smoke movement; ventilation

Klote, J. H.
Inspecting and Testing Air Moving Systems for Fire Safety.
Heating/Piping/Air Conditioning, 77-80,83-87, April 1988.
ventilation; fire safety; heating; air conditioning; smoke control; stairwells

Klote, J. H.
Project Plan for Full Scale Smoke Movement and Smoke Control Tests.
NBSIR 88-3800, 51 pp. June 1988.
Available from National Technical Information Services
PB88-233846
smoke control; air movement; fire tests; pressurization; stairwells

Klote, J. H.
Smoke Control.
SFPE Handbook of Fire Protection Engineering. 1st Edition.
Section 3. Chapter 9, National Fire
Protection Assoc., Quincy, MA, 3/143-157 pp, 1988.
smoke control; smoke movement; stack effect; buoyancy; expansion; wind; purging; stairwells

Krasny, J. F.
Krasny, J. F.; Huang, D.
Small Flame Ignitability and Flammability Behavior of Upholstered Furniture Materials.
NBSIR 88-3771, 24 pp. June 1988.
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upholstered furniture; cone calorimeters; heat release rate; ignition; mattresses; radiant ignition

Krasny, J. F.; Rockett, J. A.; Huang, D.
Protecting Fire Fighters Exposed in Room Fires. Part 1. Comparison of Results of Bench Scale Test for Thermal Protection and Conditions During Room Flashover.
Fire Technology, Vol. 24, No. 1, 5-19, February 1988, and Clemson University. Protective Clothing--An Update and Overview of Personal Protection Against Chemical, Thermal and Nuclear Hazards. May 27-28, 1987, Clemson, NC, 1988.
protective clothing; fire fighters; room fires; flashover; burns (injuries); escape means; heat flux; thermal protection; turnout coats

Kulkarni, A. K.

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Model for Upward Flame Spread on Vertical Wall.
Combustion Institute/Eastern States Section. Chemical and Physical Processes in Combustion. 1988 Technical Meeting. December 5-7, 1988, Clearwater Beach, FL, 72/1-4 pp, 1988.
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flame spread; walls; flame propagation; mathematical models

Kulkarni, A. K.; Hwang, J. J.; Murphy, F.
Fire and Fire-Induced Flows in a Stratified Atmosphere.
Final Report. August 15, 1986-August 14, 1987.
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fire models; mathematical models; polymethylmethacrylate; salt water models; small scale fire tests; stratified flow; walls

Kulkarni, A. K.; Kim, C. I.
Heat Loss to the Interior of a Free Burning Vertical PMMA Slab and Its Influence on Heat of Pyrolysis.
Combustion Institute/Eastern States Section. Chemical and Physical Processes in Combustion. 1988 Technical Meeting. December 5-7, 1988, Clearwater Beach, FL, 70/1-4 pp, 1988.
NBS-GRANT-60NANB8D0849
plastics; polymethylmethacrylate; heat loss; interiors; heat of pyrolysis; combustion; conductive heat transfer

Lawson, J. R.

Lawson, J. R.; Walton, W. D.; Evans, D. D.
Measurement of Droplet Size in Sprinkler Sprays.
NBSIR 88-3715, 51 pp. April 1988.
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droplets; water sprays; sprinkler systems

Levin, B. C.

Levin, B. C., Committee Member
Complex Mixtures: Methods for In Vivo Toxicity Testing.
National Academy Press, Washington, DC, 237 p. 1988.

Levin, B. C.; Gurman, J. L.; Paabo, M.; Baier, L.; Holt, T.
Toxicological Effects of Different Time Exposures to the Fire Gases: Carbon Monoxide or Hydrogen Cyanide or to Carbon Monoxide Combined with Hydrogen Cyanide or Carbon Dioxide.
U.S./Japan Government Cooperative Program on Natural Resources (UJNR). Fire Research and Safety. 9th Joint Panel Meeting of the UJNR Panel. May 4-8, 1987. Norwood, MA, 1-16 pp, 1987, and Society of the Plastics Industry (SPI). Polyurethanes 88. 31st Annual Technical/Marketing Conference. October 18-21, 1988. Philadelphia, PA, 249-252 pp, 1988, and NBSIR 88-3753, 1988.
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toxicity; toxicology; fire gases; carbon monoxide; hydrogen cyanide; carbon dioxide; animals

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Further Studies of the Toxicological Effects of Different Time Exposures to the Individual and Combined Fire Gases--Carbon Monoxide, Hydrogen Cyanide, Carbon Dioxide and Reduced Oxygen.
Society of the Plastics Industry (SPI). Polyurethanes 88. 31st Annual Technical/Marketing Conference. October 18-21, 1988, Philadelphia, PA, 249-252 pp, 1988.

toxicity; carbon monoxide; hydrogen cyanide; carbon dioxide; oxygen; toxicology; animals; NBS toxicity test method

Levine, R. S.

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Users' Needs in Fire Models. Proceedings of the Ad Hoc Mathematical Fire Modeling.
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fire models; mathematical models

Madrzykowski, D.

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fire suppression; ignition; residential buildings; sprinkler systems; surfactants

Malek, D. E.

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New Models to Assess Behavioral and Physiological Performance of Animals During Inhalation Exposures.
NIST-GCR-88-551, 163 pp. October 1988.
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toxicity; carbon monoxide; animals; human behavior; hydrogen chloride; toxic gases; toxicity test methods

Marks, C. H.

Marks, C. H.; Motevalli, V.
Transient Characteristics of Unconfined Fire-Plume-Driven Ceiling Jets. Annual Report. 1986-1987.
NBS-GCR-88-540, 254 pp. February 1988.
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fire plumes; ceilings; temperature measurements; velocity measurements

Matage, T. G.

Matage, T. G.
Thermal Cracking and Variable Properties Effects on Free Boundary Layer Diffusion Flames.
NBS-GCR-88-542, 45 pp. March 1988.
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diffusion flames; cracking (fracturing); boundary layers; flame spread; mathematical models

McCaffrey, B. J.

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Flame Height.
SFPE Handbook of Fire Protection Engineering. 1st Edition. Section 1. Chapter 18, National Fire Protection Assoc., Quincy, MA, 1/298-305 pp, 1988.

flame height; diffusion flames; premixed flames; froude number; buoyancy; pool fires; jet flames; free burning fires; fire behavior

Milke, J. A.

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Water Spray Suppression of Fully-Developed Wood Crib Fires in a Compartment.
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fire suppression; crib fires; fire fighting; room fires; sprinklers; water sprays

Miller, J. H.

Miller, J. H.; Smyth, K. C.
Partial Equilibrium in Laminar Hydrocarbon Diffusion Flames.
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diffusion flames; hydrocarbons; laminar flames

Mountain, R. D.

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Light Scattering From Simulated Smoke Agglomerates.
Langmuir, Vol. 4, No. 6, 1321-1326, November/December 1988.
smoke; light scattering; agglomerates

Mulholland, G. W.

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smoke production; size distribution; visibility; smoke detection

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