



# Fire Science and Technology Inc.

## VYTENIS BABRAUSKAS, Ph.D.

CURRICULUM VITAE  
(revised 6 August 2010)

### Education

#### *Graduate*

University of California, Berkeley, Ph.D., Fire Protection Engineering, 1976. Dr. Babrauskas was the first person ever to be awarded a Ph.D. degree in Fire Protection Engineering.

University of California, Berkeley, M.S., Structural Engineering, 1972.

#### *Undergraduate*

Swarthmore College, A.B., Physics, 1968. Also, concentration in electrical engineering.



### Professional experience

1993 - present : Fire Science and Technology Inc., President. Dr. Babrauskas founded FSTI in 1993 as an organization devoted to fire safety research & development and for consulting on fire safety issues.

2002: Worcester Polytechnic Institute. Adjunct Professor, Spring Semester. Taught Special Topics-Ignition Phenomena in the Dept. of Fire Protection Engineering.

1998 : University of British Columbia. Lecturer, Winter Session. Taught fire dynamics to Master's degree students in the Fire Protection Engineering program.

1977 - 1993 : National Institute of Standards and Technology (NIST), Center for Fire Research/BFRL, Fire Prevention Engineer (note that prior to 1988 NIST was called the U.S. National Bureau of Standards). At NIST, Dr. Babrauskas headed up various programs and research groups in the area of materials flammability, fire toxicity, test method development, upholstered furniture flammability, building code fire safety requirements, and fire resistance.

1973 - 1976 : U. of California, Fire Test Laboratories, Research Specialist. During his work at UCB, Dr. Babrauskas specialized in fire modeling, test furnace design and fundamental studies on fire endurance.

1969 - 1971 : U. S. Army Corps of Engineers, Philadelphia, Civil Engineer. Dr. Babrauskas designed roads, bridges, and waterworks for the Army Corps of Engineers.

1968 - 1969 : University of Pennsylvania, Assistant instructor, Physics department. Dr. Babrauskas taught laboratory courses to physics undergraduates at the University of Pennsylvania.

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## Highlights of professional achievements

Dr. Babrauskas is a ranking international authority on the measurement of heat release from fires (which tries to answer the question, *How fast do things burn?*). In 1982 he developed the Furniture Calorimeter, which has become the medium-scale test method specified in various ASTM, NORDTEST, and Underwriters Laboratories standards. He then developed the primary method currently being used on a world-wide basis for bench-scale measurement of heat release rates. For the development of this instrument, the Cone Calorimeter, he was awarded the Department of Commerce Bronze medal in 1986. His invention was also recognized in his receiving the *R&D 100 Award* for it in 1988. The Cone Calorimeter is today considered the most important bench-scale tool for determining “how fast things burn.” It is used in approximately 200 laboratories in over 30 countries. The Cone Calorimeter standards issued by ASTM, NFPA, and ISO have been based on his works.

In 1992, the textbook **Heat Release in Fires**, Babrauskas and Grayson, eds., was published. This major work reviews the entire state of the art of measuring and predicting the growth of fires, based on quantitative engineering methods and on the newest experimental techniques, many of which were developed by Dr. Babrauskas. This is the only available monograph on the subject today.

Dr. Babrauskas has contributed significantly to advancing the state of the art in quantifying the fire hazards associated with **toxicity**. He headed the research team developing the new radiant-heating test method for toxic potency, the first such to be based on effective full-scale validation with room fires. He also developed a methodology for consistently handling carbon monoxide in relation to toxicity contributions from other fire gases. The dominant role of carbon monoxide in fire gas toxicity can now be more easily studied with another of Dr. Babrauskas’ instruments, the phi-meter. In 2008 he was editor for the reference book on toxicity and the hazards of combustion products, **Hazards of Combustion Products**.

Fires from furniture and furnishings were first quantified in the course of Dr. Babrauskas research at NIST. The first predictive methods in this area were also his contribution. He remains very active in this area and has served as consultant to European laboratories investigating furniture flammability. His latest contribution in this area is the textbook **Fire Behavior of Upholstered Furniture and Mattresses**, published in 2001.

In the fire modeling area, Dr. Babrauskas was the first U.S. scientist to develop and make available to the public a computer program for modeling fires—COMPF was released in 1975. Subsequently, he released an enhanced version, COMPF2, in 1979. The enhanced version was the first fire model to include a realistic representation of the burning of liquid pool fires in rooms. He also contributed material to the major NIST fire model HAZARD I.

Dr. Babrauskas’ earliest contributions to fire safety were in the fire endurance area. His Ph.D. dissertation was in this area and remains one of the essential references in the scientific study of post-flashover fires and of fire test methods.

Since his founding of FSTI, Dr. Babrauskas specialized in fire safety R&D and in serving as a fire science consultant to fire investigations and fire litigations. In the R&D area, he has been a technical consultant to three major, multi-national fire safety research projects organized by the

European Commission: CBUF, TOXFIRE, and FIPEC. CBUF (Combustion Behaviour of Upholstered Furniture) focused on characterizing furniture fire performance and developing fire models and fire test methods for this category of product. TOXFIRE focused on developing firefighting guidance for fires in chemical and pesticide warehouses, with an emphasis on toxic products of combustion and pollution of air and water. FIPEC (Fire Performance of Electric Cables) was organized to develop fire testing and fire modeling techniques for proper assessment of electric cable flammability. In addition, under the auspices of his own firm, Dr. Babrauskas organized numerous full-scale and bench-scale fire tests on diverse construction products, where the focus has been in assessing strategies for describing the fire toxicity aspects of products.

In 2003, Dr. Babrauskas published a massive **Ignition Handbook**. This 1116-page handbook is the first ever to be published on this topic and was developed as a resource intended to serve fire safety engineers, fire investigators, forensic scientists, insurance company personnel, chemical engineers, and other professionals concerned with fire and explosion safety.

In 2005, he became the first-ever consultant that ASTM formally retained to assist in the process of development of their fire test standards and was tasked with distilling recommendations for ASTM standards from the research findings on the fire and collapse of the World Trade Center.

Dr. Babrauskas has served as editor to two editions (2003 and 2007) of **Fire Science Applications to Fire Investigations**. This is the only extensive, up-to-date collection of research papers on the topics of fire investigation and forensic applications of fire science.

## **Society memberships**

American Society for Testing and Materials (since 1973)  
 The Combustion Institute (since 1975)  
 International Association of Fire Safety Science (since 1989)  
 International Association of Arson Investigators (since 1996)  
 International Code Council; formerly ICBO (since 1993)  
 National Fire Protection Association (since 1975)  
 Society of Fire Protection Engineers (since 1991; grade of Fellow)

## **Technical committee participation**

ASTM Committee D-9 on Electrical and Electronic Insulating Materials, Member (1991- ).  
 ASTM Committee D-20 on Plastics, Member (1996- ).  
 ASTM Committee E-5 on Fire Standards (1973 - ); served as Chairman of Subcommittee E-5.21 on Smoke and Combustion Products (1998 – 2003).  
 ASTM Committee E-27 on Hazard Potential of Chemicals, Member (1999- ).  
 ASTM Committee E-30 on Forensic Sciences, Member (2004- ).  
 International Association of Fire Safety Science – management Committee (2005- )  
 ISO Technical Commission of Fire Safety, TC 92/SC 1/WG 2 Working Group on Ignitability, Assigned U.S. expert.  
 NFPA Technical Committee on Fire Investigations, NFPA 921, Member (2006- ).  
 NFPA Safety to Life/Technical Committee on Furnishings and Contents, Member (1994- ).  
 SFPE Standards Making Committee on Calculating Fire Exposures to Structures Calculating Fire Exposures to Structures, Member (2004- ).  
 SFPE Task Group on Fire Exposures, Member (2002-2004).

UL Standards Technical Panel STP 723 Surface Burning Testing of Building Materials, Member (2003- ).

UL Standards Technical Panel STP 1040 Fire Tests of Insulated Wall Constructions, Member (2004- ).

UL Standards Technical Panel STP 1820 Fire Tests of Pneumatic Tubing and Plastic Sprinkler Pipe for Flame and Smoke Characteristics (2005- ).

## Editorial positions

FIRE SAFETY JOURNAL, Regional Editor for North America (1989-2009)

FIRE AND MATERIALS, Member of Editorial Board

JOURNAL OF FIRE SCIENCES, Member of Editorial Board

JOURNAL OF CIVIL ENGINEERING AND MANAGEMENT, Member of Editorial Board.

## Professional awards

Howard W. Emmons Lectureship, IAFSS, 2008 (the Society's highest award)

Arthur B. Guise Medal, Society of Fire Protection Engineers, 2004 (the Society's highest award)

Vilhelm Sjölin Award, Forum for International Cooperation on Fire Research, 2002

Jack Bono Engineering Communications Award, SFPE, 1997

Research Award for Foreign Specialists, Building Research Institute, Japan, 1997

The S. H. Ingberg Award, ASTM, 1995

The Edward Bennett Rosa Award, NIST, 1992

ASTM Award of Recognition, 1991

Interflam Trophy Award, Interflam Conferences, 1990

Building and Fire Research Laboratory Communicator Award, NIST, 1990

ASTM Award of Appreciation, 1989

R&D 100 Award, for developing the Cone Calorimeter, 1988

Research Award for Foreign Specialists, Building Research Institute, Japan, 1988

U.S. Department of Commerce Bronze Medal, 1986

## Inventions

**The Cone Calorimeter.** An instrument for measuring fire properties of materials and products in bench scale. It is currently in the main technique for making this measurement that is in use by laboratories worldwide.

**The furniture calorimeter (open-burning products calorimeter).** This instrument measures the fire property of furniture items, stored goods, appliances, and other less-than-room sized commodities. It is currently in use in several dozen laboratories worldwide.

**The radiant furnace fire toxicity test.** This apparatus was jointly developed at several institutions. Dr. Babrauskas headed the NIST development team. It is a bench-scale test used to determine the fire toxicity properties of materials and products.

**The phimeter.** This instrument determines the real-time combustion equivalence ratio of fires. It is used in studies of fire toxicity.

## Engineering standards

The following standards in the fire safety area were primarily developed by Dr. Babrauskas or were based on his inventions:

- ASTM E 1354 (Cone Calorimeter)
- ISO 5660 (Cone Calorimeter)
- NFPA 271 (Cone Calorimeter)
- NFPA 269 (fire toxicity)
- ASTM E 1474 (furniture test, bench-scale)
- NFPA 272 (furniture test, bench-scale)
- UL 1056 (furniture test, large-scale)
- NFPA 267 (mattress test)
- ASTM E 1590 (mattress test)
- ASTM E 1357 (furniture test, large-scale)
- NFPA 266 (furniture test, large-scale)
- NORDTEST NT FIRE 032 (furniture test, large-scale)
- CAN/ULC-S135 (combustibility of materials and products)
- MIL-STD-2031 SH (naval composites)
- NASA NHB 8060.1C (elevated oxygen material test)
- ASTM F 1550M (bench-scale test for prison mattresses and furniture)

## Science and engineering expertise and work areas

- instrument design
- physics
- heat transfer
- civil/structural engineering
- electrical engineering
- combustion science
- analytical chemistry: methods for gas analysis
- infrared spectroscopy
- full-scale engineering performance testing

*Within fire safety science and fire protection engineering:*

- fire resistance
- fire toxicity
- fire testing
- electrical fires
- electrical explosions
- electrical arcs
- furniture flammability
- fire corrosivity
- ignitability
- self-heating and spontaneous combustion
- failure analysis
- ignition of fires from electric faults and failures
- flame spread
- explosions

- heat release rate
- computer fire modeling
- pool fires
- smoke production
- computer methods for handling of fire test data
- design and development of fire test apparatuses and instrumentation

## Fire modeling

Dr. Babrauskas was the first U.S. scientist to publish a computer fire model (COMPF, issued in 1975). He contributed material to the major NIST fire model HAZARD I. His model for liquid pool fires is the most commonly used one. During 1993-1994, as technical consultant for the major European research program on upholstered furniture flammability CBUF, he played a pivotal role in developing the three different furniture fire models which were produced. He has developed numerous methods for fire hazard analysis which have been published in various technical journals.

## Teaching

Dr. Babrauskas has given hundreds of lectures and presentations. He has taught graduate-level engineering courses at the University of British Columbia and at Worcester Polytechnic Institute. In recent years, he has been regularly teaching classes to fire investigators on fire science principles, as applied to origin-and-cause investigation of fires. He developed the unique **Electrical Fires 102** course, which is the only advanced course on investigation of electrical fires focusing on the fundamental underlying principles.

## Publications

Dr. Babrauskas has published nearly 300 papers and reports in the field of fire safety science and engineering. His textbook **Heat Release in Fires** is the first and only book on this important subject. His **Ignition Handbook** is the only handbook on the topic of ignition and is one of the largest handbooks published on any safety topic. He authored the first monograph devoted to the topic of upholstered furniture flammability while at NIST; a second edition of this work was published commercially in 2000. He also authored the first comprehensive state-of-the-art review of flammability test methods for wires and cables. His Ph.D. dissertation on **Fire Endurance in Buildings** is still considered as one of the pivotal references in its field. Dr. Babrauskas has contributed chapters to both the NFPA and the SFPE Handbooks.

A selected list of publications is as follows. The complete listing is available on request.

Babrauskas, V., Electric Arc Explosions, pp. 1283-1296 in *Interflam 2010—Proc. 12<sup>th</sup> Intl. Conf.*, Interscience Communications Ltd, London (2010).

Babrauskas, V., Electrical Fires: Research Needed to Improve Fire Safety, *Fire Protection Engineering* No. 46, 20-22, 24-26, 28-30 (2<sup>nd</sup> Q. 2010).

Babrauskas, V., Unexposed-Face Temperature Criteria in Fire Resistance Tests: A Reappraisal, *Fire Safety J.* **44**, 813-818 (2009).

Babrauskas, V., and Krause, U., Ignition Sources, pp. 13-31 in **Fires in Silos**, U. Krause, ed., Wiley-VCH Verlag, Weinheim (2009).

Babrauskas, V., Fleming, J. M., and Russell, D. B., RSET/ASET, A Flawed Concept for Fire Safety Assessment, pp. 315-328 in *Proc. Fire & Materials 2009*, Interscience Communications Ltd, London (2009).

Babrauskas, V., and Janssens, M., Quantitative Variables to Replace the Concept of 'Noncombustibility,' pp. 77-90 in *Proc. Fire & Materials 2009*, Interscience Communications Ltd, London (2009).

Babrauskas V., Research on Electrical Fires: The State of the Art (The Emmons Plenary Lecture), pp. 3-18 in *Fire Safety Science—Proc. 9<sup>th</sup> Intl. Symp.*, Intl. Assn. for Fire Safety Science, London (2009).

Babrauskas, V., Electrical Fires, pp. 3-479 to 3-498 in **The SFPE Handbook of Fire Protection Engineering**, 4<sup>th</sup> ed., National Fire Protection Assn., Quincy MA (2008).

Babrauskas, V., The Cone Calorimeter, pp. 3-90 to 3-108 in **The SFPE Handbook of Fire Protection Engineering**, 4<sup>th</sup> ed., National Fire Protection Assn., Quincy MA (2008).

Babrauskas, V., Heat Release Rates, pp. 3-1 to 3-59 in **The SFPE Handbook of Fire Protection Engineering**, 4<sup>th</sup> ed., National Fire Protection Assn., Quincy MA (2008).

Babrauskas, V., Smoke Detectors: Technologies Are NOT of Equal Value or Interchangeable, *Fire Safety & Technology Bull.* 3:12, 2-4 (Dec. 2008).

Babrauskas, V., Quantifying the Combustion Product Hazard on the Basis of Test Results, pp. 339-353 in **Hazards of Combustion Products: Toxicity, Opacity, Corrosivity and Heat Release**, V. Babrauskas, R. G. Gann, and S. J. Grayson, eds., Interscience Communications Ltd., London (2008).

Babrauskas, V., and Grayson, S. J., Heat Release Test Methods, pp. 255-282 in **Hazards of Combustion Products: Toxicity, Opacity, Corrosivity and Heat Release**, V. Babrauskas, R. G. Gann, and S. J. Grayson, eds., Interscience Communications Ltd., London (2008).

Babrauskas, V., Gann, R. G., and Grayson, S. J., eds., **Hazards of Combustion Products: Toxicity, Opacity, Corrosivity and Heat Release**, Interscience Communications Ltd., London (2008).

Babrauskas, V., Ignition of Gases, Vapors, and Liquids by Hot Surfaces, pp. 5-13 in *ISFI 2008—Proc. 3<sup>rd</sup> Intl. Symp. on Fire Investigation Science & Technology*, Natl. Assn. of Fire Investigators, Sarasota FL (2008).

Babrauskas, V., Upholstered Furniture and Mattresses, pp. 6-103 to 6-128 in **Fire Protection Handbook**, 20<sup>th</sup> ed., National Fire Protection Assn., Quincy MA (2008).

Babrauskas, V., Tables and Charts, pp. 6-269 to 6-294 in **Fire Protection Handbook**, 20<sup>th</sup> ed., National Fire Protection Assn., Quincy MA (2008).

Babrauskas, V., Ignition: A Century of Research and an Assessment of Our Current Status, *J. Fire Protection Engineering* **17**, 165-183 (2007).

Babrauskas, V., Gray, B. F., and Janssens, M. L., Prudent Practices for the Design and Installation of Heat-Producing Devices near Wood Materials, *Fire & Materials* **31**, 125-135 (2007).

Babrauskas, V., Engineering Design and Analysis Using Computer Models: Are We Going Too Fast or not Fast Enough?, pp. 1-9 in *Proc. Interflam 2007*, Vol. 1, Interscience Communications Ltd., London (2007).

Babrauskas, V., and Simonson, M., Fire Behaviour of Plastic Parts in Electrical Appliances—Standards versus Required Fire Safety Objectives, *Fire & Materials* **31**, 83-96 (2007).

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Babrauskas, V., Unexposed-face Temperature Criteria in Fire Resistance Tests: A Reappraisal, *Proc. Fire and Materials 2007*, Interscience Communications Ltd., London (2007).

Babrauskas, V., The Principles of Electrical Fires, pp. 45-51 in *IFSI 2006 - Proc. 2<sup>nd</sup> Intl. Symp. on Fire Investigation Science and Technology*, Natl. Assn. of Fire Investigators, Sarasota FL (2006).

Babrauskas, V., Mechanisms and Modes for Ignition of Low-voltage, PVC-insulated Electrotechnical Products, *Fire & Materials* **30**, 150-174 (2006).

Babrauskas, V., Effective Heat of Combustion for Flaming Combustion of Conifers, *Canadian J. Forest Research* **36**, 659-663 (2006).

Babrauskas, V., Ignition of Solids—What Have We Learned in a Half-Century of Research? pp. 89-97 in *Flame Retardants 2006*, Interscience Communications Ltd, London (2006).

Babrauskas, V., Charring Rate of Wood as a Tool for Fire Investigations, *Fire Safety J.* **40**, 528-554 (2005).

Babrauskas, V., Risk of Ignition of Forest Fires from Black Powder or Muzzle-Loading Firearms, report prepared for the U.S. Forest Service, San Dimas T&D Center (2005).

Babrauskas, V., Some Basic Facts About Ignition Events During Fueling of Motor Vehicles at Filling Stations, *California Fire/Arson Investigator* **16**, 25 (Apr. 2005).

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Babrauskas, V., Facade Fire Tests: Towards an International Test Standard, *Fire Technology* **32**, 219-230 (1996).

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- Snell, J. E., Babrauskas, V., and Fowell, A. J., Elements of a Framework for Fire Safety Engineering, pp. 447-456 in INTERFLAM '93, Interscience Communications Ltd, London (1993).
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- Babrauskas, V., and Grayson, S. J., eds., **Heat Release in Fires**, Elsevier Applied Science Publishers, London (1992).
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