

David B. Rich, PhD

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Professional Profile

Dr. Rich is a founding partner and Principal Engineer at Reax Engineering Inc., a thermal sciences consulting firm based in San Francisco's Bay Area. He is a fire expert with comprehensive experience in the fire testing laboratory and with large scale fire testing supported by sophisticated analysis and modeling tools. David is an experienced designer and peer reviewer of building fire safety systems, especially performance-based systems supported by computational methods and scale modeling. He has broad experience as an expert in conducting fire scene investigations, reviewing expert opinions, evidence collection, legal matters, systems analysis, experimental investigations, computational fire modeling and graphics support for trial and mediation. He brings a diverse background to engineering with research and development experience in combustion both in academia and the private sector and bioengineering and mechanical design combined with practical experience as a Rescue Captain and Paramedic in the San Francisco Fire Department. He earned his PhD in the Combustion and Fire Processes Laboratory at the University of California at Berkeley working on NASA funded research to better understand the behavior of polymer fire behavior in zero gravity conditions. He is a lecturer in the Department of Mechanical Engineering at UC Berkeley and in thermo-fluid sciences at Santa Clara University. He is technical advisor to IEC Technical Committee 108 on safety of electronic equipment within the field of audio/video, information and communication technology, and a voting member of the U.S. 108 Technical Advisory Group (TAG) where he provides expertise in flammability behavior of electronics, relevant fire test methods, and regulatory requirements, especially relating to polymer enclosures. He is also a member of IEC TC 89 U.S. TAG on Fire Hazard Testing. Dr. Rich is also a voting member of ASTM Committee E05 on Fire Testing and has addressed this group on issues of fire safety of plastic enclosures.

Professional Licensure and Certifications

- Private Instrument Pilot
- Hazardous Materials First Responder Operational
- PADI Scuba Diving Instructor

Education

PhD – Mechanical Engineering, University of California at Berkeley, 2006

- Dissertation – “Ignition Delay and Flame Spread Characteristics of Polymers Intended for use on Space Craft”
- Major field: Combustion

BS/MS – Mechanical Engineering, University of California, Berkeley, 2000-2002

Professional Experience

2008 – present **Reax Engineering Inc.** Berkeley, CA, *Founding Partner and Principal Engineer*

Selected Policy project work:

- *International Electro-Technical Commission, Technical Committee 108 on Consumer Electronics: Technical Expert.*
- *US Technical Advisory Group, TC 108 on Consumer Electronics: Voting Member*
- *US Technical Advisory Group, TC 89 on Fire Test Methods: Voting Member*
- *Global Alliance for Incinerator Alternatives: Technical Reviewer*

Selected Peer Review project work:

- *Coalition of California Utilities and Communication Providers and CPUC*: Wildland fire risk modeling, weather effects on ignition and flame spread.
- *Foster and Partners Architects*: Performance based sprinkler design development and test witnessing.
- *City and County of San Francisco Fire Department*: Multiple (6) fire stopping equivalency judgements.
- *City and County of San Francisco Fire Department*: Smoke control system and weather interactions, municipal rail infrastructure.
- *State of California Fire Marshal's Office*: Prison smoke control system and egress modeling.
- *Global Alliance for Incineration Alternatives*: Multiple (5) reviews of incinerator plant designs for feasibility.
- *City and County of San Francisco Department of Building Inspections*: Residential high rise smoke control modeling and regulatory requirements for proposed code change.
- *City and County of San Francisco Department of Building Inspections*: School ventilation system.

Selected Fire Testing project work:

- *Confidential Client, Product development*: Thermal and flammability design of wallboard, cone calorimeter, thermal conductivity.
- *California Energy Commission, Fire Life Safety*: Scale modeling of fire induced flows in buildings.
- *City and County of San Francisco Fire Department*: Municipal railway fire testing and material property estimation.
- *Confidential Client, Biofuels*: Testing and modeling of fuel flash points, modeling of fuel dispersion code and regulatory requirements for industrial chemical process.
- *Darfur Stoves Project*: Testing and modeling of cook stove for rural communities.
- *Confidential Client*: Development of large-scale tunnel fire sprinkler test apparatus.
- *Guinness Book of World Records/History Channel*: Human fire walk record instrumentation and documentary commentary.

Representative Design project work

- *Hanford Nuclear Facility, Fire Safety*: Fire safety design for radioactive heating of filter elements.
- *JDSU, Hazardous Liquids Storage*: Fire safety design for storage in industrial occupancy.
- *Confidential Client, Pyrolysis plant modeling*: Modeling support for tire pyrolysis process.
- *Confidential Client, Biofuels*: Modeling of industrial process plume dynamics.
- *Confidential Client, Ethanol Fuel Handling*: Development of an ethanol flame arrestor for use in consumer fuel bottles. Production of comprehensive fire safety literature.
- *Ability Production Architects*: CFD modeling of a public pool ventilation system.
- *Signum Architecture*: Alternative methods of compliance, winery re-design project.
- *Foundation Capital*: Developed prototype vapor absorption refrigeration for vaccine delivery.
- *Jeffries and CO., Computer data center fire systems*: Oversee updates to fire suppression system.
- *Confidential Client, combustion emissions control*: Development and implementation of a comprehensive material fire properties test and modeling program.
- *Confidential Client, electronic cigarette*: Prototype development of a smokeless cigarette.
- *San Francisco Municipal Rail*: Fire safety assessment of art exhibit.
- *California Utilities and Communication Providers*: Wildland fire risk modeling, weather effects on ignition and flame spread.
- *San Francisco Public Utilities Commission*: Lead developer of organization disaster plan.
- *SEQ Energy*: Thermodynamic analysis of graphene pyrolysis process.
- *Stanford University*: Design and cold smoke testing of naturally ventilated atrium.
- *Wooley Classic Suites, Paller and Associates Architects*: Design of hotel atrium smoke management system.

- *TJPA Transbay Terminal Overpass*: Thermal/Structural analysis.
- 2013-Present **University of California, Berkeley, Lecturer**
- Thermo-fluid sciences, 2-3 course per annum.
- 2011-2018 **California Poly San Luis Obispo, Program in Fire Protection Engineering, Instructor**
- Taught Flammability Assessment Methods, Smoke Management and Special Hazards, 2 courses per annum.
- 2008-2011 **Santa Clara University, Department of Mechanical Engineering, Adjunct Professor**
- Graduate and Undergraduate courses in Fluid Mechanics, Thermodynamics, Combustion, Fire Dynamics, and Internal Combustion Engine Technology
- 2008 – 2011 **University of California, Berkeley Doctoral, Post-Doctoral Researcher, Staff Researcher**
- Development of carbon neutral fuels from cellulosic feedstock, Scale model and laser imaging of building smoke flows for innovative ventilation (under floor, natural) systems and validation of FDS models, Combustion testing and modeling to characterize fuels and measure energy efficiency of specially developed stoves for use in developing countries.
 - Developed and implemented a forced ignition and flame spread test for polymer materials intended for use in the microgravity conditions of spacecraft.
- 2007 – 2008 **Arup Fire, San Francisco, CA Fire Protection Specialist**
- Worked in conjunction with engineering teams, architects, and approving authorities, to develop integrated fire safety strategies for buildings and transportation systems.
- 1991 – 1999 **San Francisco Fire Department, San Francisco, CA, Paramedic/Rescue Captain**
- Provided 911 emergency services, conducted community disaster training, and implemented federal multi-agency programs to manage casualties of weapons of mass destruction.

Selected Publications

1. Bar-Ilan, A., Rich, D., Rein, G., & Fernandez-Pello, A.C., “Flow-Assisted Flame Propagation through a Porous Combustible in Microgravity,” *Western States Section/The Combustion Institute*, San Diego, CA, 2002.
2. Cheng, E.S., Rich, D., Dibble R.W., & Buckholz, B.A., “Quantifying the Contribution of Lubrication Oil to Particulate Emissions from a Diesel Engine,” *Journal of the Society of Automotive Engineers*, 2003.
3. Lautenberger, C., Stevanovic, A., Rich, D., & Torero, J., “Effect of Material Composition on Ignition Delay of Composites,” *Composites 2003*, Anaheim CA, October 2003.
4. Lautenberger, C., Stevanovic, A., Rich, D., Torero, J. & Fernandez-Pello, A.C., “An Experimental and Theoretical Study on the Ignition Delay Time of Composite Materials,” *Western States Section/The Combustion Institute*, Los Angeles CA, October 2003.
5. Rich, D., Lautenberger, C., Stevanovic, A., Metha, S., Torero, J., Yuan, Z., Ross, H., Fernandez-Pello, C., “Piloted Ignition of Polypropylene/Glass Composites in a Forced Air Flow,” *7th International Workshop on Microgravity Combustion and Chemically Reacting Systems*, Cleveland, OH, 2003.
6. Lautenberger, C., Rich, D., Yuan, Z., & Fernandez-Pello, C., “Modeling Ignition of Solid Combustibles in Normal and Micro Gravity,” Work in progress poster presented at the *30th International Symposium on Combustion*. Chicago, IL, 2004.
7. Rich, D., Lautenberger, C., Hernandez, J., & Fernandez-Pello, A.C. “Effect of Environmental Variables on Critical Pyrolysate Mass Flux for Piloted Ignition of PMMA and PP/GL Composite,” *Proceedings of the 4th Mediterranean Combustion Symposium*, Lisbon, Portugal, 2005.
8. Rich, D., Lautenberger, C., McAllister, S. & Fernandez-Pello, A.C., “Microgravity Flame Spread Rates Over Samples of Polymer and Polymer/Glass Composites,” *Western States Section/The Combustion Institute*, Boise ID, March 2006.
9. Lautenberger, C., McAllister, S., Rich, D., & Fernandez-Pello, C., “Modeling the Effect of Environmental Variables on Opposed-Flow Flame Spread Rates with FDS,” *International Congress on Fire Safety in Tall Buildings*, Santander, Spain, October 2006.
10. Rich, D., Lautenberger, C., Torero, J.L., Quintiere, J.G. & Fernandez-Pello, C., “Mass Flux of Combustible Solids at Piloted Ignition,” *Proceedings of the Combustion Institute* **31** 2653-2660 (2007).

11. McAllister, S., Rich, D., Lautenberger, C., & Fernandez-Pello, C., "Modeling Microgravity and Normal Gravity Opposed Flame Spread over Polymer/Glass Composites," *45th AIAA Aerospace Sciences Meeting and Exhibit*, Reno, NV, January 2007, AIAA Paper 2007-740.
12. Lautenberger, C., McAllister, S., Rich, D., & Fernandez-Pello, C., "Effect of Environmental Variables on Flame Spread Rates in Microgravity," *45th AIAA Aerospace Sciences Meeting*, Reno, NV, Jan. 2007, AIAA 2007-383.
13. McAllister, S., Rich, D., Lautenberger, C., Fernandez-Pello, C. & Yuan, Z.G., "Modeling Microgravity and Normal Gravity Flame Spread Rates over Samples of Polymer and Polymer/Glass Composites," *Fifth International Seminar on Fire and Explosion Hazards*, Edinburgh, UK, April 2007.
14. Shaw, Susan D., Blum, A., Weber, R., Kurunthachalam, K., Rich, D., et.al., "Halogenated Flame Retardants: Do the Fire Safety Benefits Justify the Risks?," *Reviews on Environmental Health*, Volume 25, No. 4 2010.
15. Babrauskas, V., Rich, D., Singla, V., and Blum, A., "Toxic Chemicals and Toxic Money: The Science and Politics of Flammability Standards," *IAFSS Newsletter*, August 2012
16. Rich, D., "Effectiveness vs. toxicity of flame retardants, Featured Article for the incoming issue (No. 36)", *International Association of Fire Safety Science Newsletter*, No. 36, In Review, January 2014.

Professional Societies

- Society of Fire Protection Engineers (SFPE), *Member*
- National Fire Protection Association (NFPA), *Member*
- American Society for Testing and Materials (ASTM), *Member*
- International Association of Fire Safety Scientists (IAFSS), *Member*

Journal Referee / Peer Review

- *Fire Safety Journal*
- *Journal of Building and Environment*
- *Fire Technology*
- *Fire Science and Technology*
- *Proceedings of the Combustion Institute*
- *Mediterranean Combustion Symposium*