NISTIR 6030

THIRTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY, MARCH 13-20, 1996

VOLUME 1

Kellie Ann Beall, Editor

United States Department of Commerce
Technology Administration
National Institute of Standards and Technology

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THIRTEENTH MEETING OF THE UJNR PANEL ON FIRE RESEARCH AND SAFETY, MARCH 13-20, 1996

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Kellie Ann Beall, Editor

June 1997
Building and Fire Research Laboratory
National Institute of Standards and Technology
Gaithersburg, MD 20899

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KAWAGOE MEMORIAM

Symposium in Memory of Kunio Kawagoe

INTRODUCTION

The 13th meeting of the U.S.-Japan Panel on Fire Research and Safety was held at the National Institute of Standards and Technology March 13-20, 1996. It had been scheduled for October 25 - November 1, 1995 but was postponed due to uncertainties regarding the U.S. Federal budget and the eventual temporary shutdowns of the Government.

The core of the meeting consisted of technical sessions on design/risk/hazard/performance standards, burning of real objects, experimental refinement and validation of fire models, suppression, materials testing, detection, and fires after earthquakes. The last of these topics took on special meaning in the wake of two disasters since the 12th meeting: a major earthquake in Northridge, California (January 17, 1994) and the Great Hanshin-Awaji Earthquake on the largest Japanese island of Honshu (January 17, 1995). The participants intend that the losses from these momentous events will galvanize the development of solutions to mitigate future life loss and destruction.

In addition, the meeting hosted two one-day Symposia honoring two long-time principals of fire research in general and this UJNR Panel in particular. The first was in honor of Professor Edward Zukoski on the occasion of his retirement from the California Institute of Technology. We regret to report that Prof. Zukoski passed away on May 26, 1997, just prior to the publication of these Proceedings. The second symposium was in memory of Professor Kunio Kawagoe of the Building Research Institute and Tokyo Science University. Each was a celebratory event, with excellent technical papers, fond memories, and renewed friendships. Both men were outstanding contributors to fire science, and both will be deeply missed by their colleagues and friends.

Among the technical sessions, the participants found time to visit the NIST fire research laboratories, with demonstrations of CFD modeling, "Fire on the Web," research on halon alternatives and fire-safe materials, and flame measurements. The Saturday between sessions included tours of the lovely Luray Caverns and the Old Town Section of Alexandria, Virginia. These provided further opportunity for the new participants in this venerable bi-national conference to spend time with those with extensive experience, and for the veterans to strengthen the fellowship of the international fire research community. Even as these memories transition to recollection by manuscript and photograph, the plans are underway for the 14th Meeting, to be held in Japan in the spring of 1998.

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Thirteenth Joint Panel Meeting of the
UJNR Panel on Fire Research and Safety

March 13 - 20, 1996
Gaithersburg Hilton Hotel
Gaithersburg, Maryland

Wednesday, March 13, 1996 (opening ceremony and single technical session)

8:45 Opening

9:45 Leave for NIST for Group Photo

10:30 Return to Hotel, Break

Design/Risk/Hazard/Performance Standards

10:45 John R. Hall, Jr. (NFPA): **"Progress Report on Design, Risk, Hazard, and Performance-Based Codes"**

11:00 Takeyoshi Tanaka (BRI): **"Progress Report on Performance-based Fire Safety Design Method"**

11:15 Brian Meacheam (SFPE): **"Society of Fire Protection Engineers (SFPE) Perspectives of Performance-Based Fire Safety Design"**

11:45 Shuji Kakegawa (Shimizu Corp.): **"Life Safety Evaluation of Large Populations with Mixed Abilities"**

12:15 Lunch

13:15 Rita Fahy (NFPA): **"High Rise Evacuation Modeling--Data and Applications"**

13:45 Manabu Ebihara (Shimizu Corp.): **"Assessment of Clarity of Egress Route in Buildings"**

14:15 Takeyoshi Tanaka (BRI): **"A Consideration on Required Number of Exits in a Room -- A Study on the Safety Performance of Exit Provisions -- Part 1"**

14:45 Ichiro Hagiwara (BRI): **"A Consideration on Common Path Length and Single Stairway -- A Study on the Safety Performance of Exit Provisions -- Part 2"**

15:15 Break

15:45 Dick Bukowski (BFRL): **"Risk and Performance Standards"**

16:15 David Stroup (BFRL): **"Using Fire Models to Establish Performance Requirements for the Design of Buildings"**

16:45 Barbara Lippiatt (BFRL): **"Cost-effective Compliance with the Life Safety Code for Health Care Occupancies"**

17:15 Adjourn

Thursday, March 14, 1996 (single technical session)

Burning of Real Objects

8:30 Tom Ohlemiller (BFRL): **"Flammability of Real Objects: A Progress Report"**

8:45 Osami Sugawa (Science University of Tokyo): **"Progress Report on Full Scale Fire Test in Japan"**

9:00 Craig Beyler (Hughes Assoc.): **"Upward Flame Spread on Vertical Surfaces"**

9:30 Yuji Hasemi (BRI): **"Wall Flame Correlations and Upward Flame Spread a Vertical Channel and Its Relevance to Fire Safety"**

10:00 Ronald Alpert (Factory Mutual Research Corp.): **"Assessment of Material Flammability with the FSG Propagation Model and Laboratory Test Methods"**

10:30 Break

11:00 Yuji Hasemi (BRI): **"Concurrent Flame Spread in Fires--State of the Art of Modeling and Future Problems for Engineering Application"**

11:30 Henri Mitler (BFRL): **"Input Data for Fire Modeling"**

12:00 Lunch

13:00 Jayavant Gore (Purdue Univ.): **"Measurement and Predictions of the Velocity Field Induced by Pool Fires"**

13:30 Pravinray Gandhi (Underwriters Laboratories): **"Corrosion from Combustion Products--An Overview"**

14:00 End of Session

14:15 Bus to NIST

14:30 Lab Tour

16:30 Adjourn, Bus to Hotel

17:30 Leave Hotel for Shopping and Dinner

Friday, March 15, 1996

Zukoski Symposium

9:00 Howard Emmons (Harvard University): **"A Universal Orifice Flow Formula"**

9:40 Yuji Hasemi (BRI): **"Modeling of Heating Mechanism and Thermal Response of Structural Components Exposed to Localized Fires: A New Application of Diffusion Flame Modeling to Fire Safety Engineering"**

10:20 Break

10:40 Howard Baum (BFRL): **"Large Eddy Simulations of Smoke Movement in Three Dimensions"**

11:20 Makoto Tsujimoto (Nagoya University): **"Experimental Study of Smoke Movement with Scale Model"**

12:00 Lunch

1:30 Hiroshi Hayasaka (Hokkaido University): **"Radiation Transfer and Temperature Distribution in a Few Small Pool Flames"**

2:10 Gerard M. Faeth (University of Michigan): **"Self-preserving Buoyant Turbulent Plumes"**

2:50 Baki M. Cetegen (University of Connecticut): **"Characteristics of Oscillating Buoyant Plumes"**

3:30 Break

3:50 Gunnar Heskestad (Factory Mutual Research Corp.): **"On Q* and the Dynamics of Diffusion Flames"**

4:30 Patrick Pagni (University of California, Berkeley): **"Zukoski's Intellectual Progeny"**

5:30 Reception

7:00 Banquet

Monday, March 18, 1996 (Kawagoe Memoriam)

~Sponsored by the Japanese Delegates ~

Kawagoe Memoriam

9:00 Yoshio Mimura (BRI): **"Opening Remarks"**

9:20 Jack Snell (BFRL): **"Memory of Professor Kawagoe"**

9:40 Alex Robertson (former NBS): **"Recollection of Meetings with Kunio Kawagoe"**

10:00 Takashi Sekine (Former Co-worker of Prof. Kawagoe, possible presented by Hayashi): **"Behavior of Wind Blown Crib Fires"**

10:30 Break

11:00 Jim Quintiere (U. Maryland): **"Fire Investigation"**

11:30 Takeyoshi Tanaka (BRI): **"Simple Formula for Ventilation Controlled Fire Temperatures"**

12:00 Lunch

13:00 John Rockett (former NBS): **"Zone Model Plume Algorithm Performance"**

13:30 Masahiro Morita (Sci. Univ. of Tokyo): **"Mathematical Modeling for Building Fire"**

14:00 Bud Nelson (Hughes Associates): **"Performance Based Fire Safety"**

14:30 Osami Sugawa (Sci. Univ. of Tokyo): **"Flame Length and Width Produced by Ejected Propane Gas Fuel from a Pipe"**

15:00 Break

15:30 George Mulholland (BFRL): **" The Effect of Pool Diameter on the Properties of Smoke Produced by Crude Oil Fires"**

16:00 Kazunori Harada (Kyoto Univ.): **"Heat and Mass Transfer in the Walls Subjected to Fire"**

16:30 Yuji Hasemi (BRI): **"Full-Scale Burn Test of Wooden Three-Story Apartment Building"**

17:00 Adjourn

18:00 Cocktail Hour
19:00 Dinner Reception

Tuesday, March 19, 1996 (double technical session)

Session One
Experimental Refinement and Validation of Fire Models

8:30 Yoshihiko Hayashi (BRI): **"Progress Report on Fire Modeling -- Numerical Simulation of Variable Density Flow with High Buoyancy"**

8:45 Walter Jones (BFRL): **"Progress Report on Fire Modeling and Validation"**

9:00 Kermit Smyth (BFRL): **"Computations of Enhanced Soot Production in Flickering Diffusion Flames"**

9:30 Tokiyoshi Yamada (FRI): **"Experimental Study of the Exchange Flow through a Horizontal Ceiling Vent in Atrium Fires"**

10:00 Osami Sugawa (Sci. Univ. Of Tokyo): **"Modeling on Temperature and Ventilation Induced by a Model Fire in a Tall and Narrow Atrium Space"**

10:30 Break

10:45 Hiroshi Koseki (FRI): **"Radiation Properties and Flame Structure of Large Hydrocarbon Pool Fires"**

11:15 Bill Pitts (BFRL): **"Carbon Monoxide Formation Algorithm"**

11:45 Lunch

12:45 Walter Jones (BFRL): **"The Fire Hazard Assessment Methodology"**

13:15 Yoshifumi Ohmiya(Sci. Univ. of Tokyo) **"A Room Fire Model in View of Predicting Fire Spread by External Flames"**

13:45 Rick Peacock (BFRL): **"Evaluation of Complex Fire Models"**

14:15 Takeyoshi Tanaka (BRI): **"Experiments on Smoke Behavior in Cavity Spaces"**

14:45 Walter Jones/Rebecca Portier (BFRL): **"A Prototype FDMS Database for Model Verification"**

15:15 Adjourn

Tuesday, March 19, 1996 (double technical session)
Session Two
Suppression

8:30 Richard G. Gann (BFRL): **"Progress Report on Fire Suppression Research in the U.S."**

8:45 Naoshi Saito (FRI): **"Progress Report on Suppression in Japan"**

9:00 Anthony Hamins (BFRL): **"Flame Suppression by Halon Alternatives"**

9:30 Naoshi Saito (FRI): **"Evaluation of Fire Suppression Efficiency of Halon Replacements in Japan"**

10:00 Jack Mawhinney (Hughes Assoc.): **"Status Report on Water Mist Fire Suppression Systems -- 1996"**

10:30 Break

10:45 Ai Sekizawa (FRI): **"Experimental Study on Fire Hazard of Residential Fires Before and After Sprinklers Activation"**

Materials and Testing

11:15 Yuji Hasemi (BRI): **"Progress Report on Materials and Test Methods"**

11:30 Takashi Kashiwagi (BFRL): **"Progress Report on U.S. Research on Test Methods and Materials"**

11:45 Lunch

12:45 Yuji Hasemi (BRI): **"Asia-Oceania ISO5660 Cone Calorimeter Inter-Laboratory Trials"**

13:15 Tom Ohlemiller (BFRL): **"Flammability of Upholstered Furniture"**

13:45 Yuji Hasemi (BRI): **"Heat Release Rates Measured by Cone Calorimeter and Intermediate Scale Electrical Radiant Panels"**

14:15 Eiji Yanai (FRI): **"A Flammability Test for Granular Synthetic Resins Using a Modified Oxygen Index Method"**

14:45 Richard Lyon (FAA Technical Center): **"Advanced Fire safe Materials for Aircraft Interiors"**

15:15 Jeff Gilman (BFRL): **"Fire Retardant Additives for Polymeric Materials - I. Char Formation from Silica Gel--Potassium Carbonate"**

15:45 Adjourn

Wednesday, March 20, 1996 (double technical session and closing ceremony)

Session One
Fires After Earthquakes

8:30 David Evans (BFRL): **"Progress Report on Fires Following the Northridge Earthquake"**

8:45 Akihiko Hokugo (BRI): **"Progress Report on Fires Following the 1995 Great Hanshin-Awaji Earthquake"**

9:00 Ai Sekizawa (FRI): **"Post-Earthquake Fires and Firefighting Activities in the Early Stage in the 1995 Great Hanshin Earthquake"**

9:30 Frank Borden (City of Los Angeles Fire Dept.): **"The 1994 Northridge Earthquake and the Fires That Followed"**

10:00 Break

10:30 Akihiko Hokugo (BRI): **"The Performance of Fire Protection of Buildings Against the Fires Following the Great Hanshin-Awaji Earthquake"**

11:00 Charles Scawthorn (EQE Engineering): **"Fires Following the Northridge and Kobe Earthquakes"**

11:30 Kazuyoshi Ohnishi (Kobe Univ.): **"Causes of the Seismic Fires Following the Great Hanshin-Awaji Earthquake-Survey"**

12:00 Lunch

13:00 Daniel Madrzykowski (BFRL): **"Durable Agents for Exposure Protection in Wildland/Urban Interface Conflagrations"**

13:30 Kevin McGrattan (BFRL): **"Smoke Plumes from Large Fires"**

14:00 Closing

15:00 Adjourn

Wednesday March 20, 1996 at the Hilton

Session Two
Detection

8:30 Bill Grosshandler (BFRL): **"Progress Report on Fire Detection Research in the U.S."**

8:45 Hiroaki Tamura (FRI): **"Progress Report on Detection Research in Japan"**

9:00 Bill Grosshandler (BFRL): **"Test Fire Signatures and the Fire-Emulator/Detector-Evaluator"**

9:30 Ron Mengel (System Sensor): **"Industry Advances in Fire Detection Technology"**

10:00 Break

10:30 Joji Kawada (Nohmi Bosai Ltd): **"Fire Detection in Atrium Buildings"**

11:00 James A. Milke (Dept. of Fire Protection): **"Multivariate Methods for Fire Detection"**

11:30 Bill Davis (BFRL): **"NASA Fire Detection Study"**

12:00 Lunch

14:00 Closing

15:00 Adjourn

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13th Joint Panel Meeting
UJNR Panel on
Fire Research and Safety
NIST
National Institute of Standards and Technology
Building and Fire Research Laboratory
March 13-20, 1996

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OPENING REMARKS

Dr. Richard N. Wright
Building and Fire Research Laboratory

Dr. Mimura, Dr. Snell, it gives me great pleasure to welcome the Thirteenth Joint Meeting of the UJNR Panel on Fire Research and Safety. Our increasing urbanization and growing fire losses show that your work is of increasing importance to our nations and the world. The tragic fires following the Hyogo ken Nanbu earthquake on January 17, 1995 specifically illustrate the need for your work.

Your program describes advances in fire science and fire safety engineering that confirm that resolute efforts in research and development and implementation of fire safety practices can address our two nations' needs for risk reduction.

Among my responsibilities are to chair the U.S.-side of the UJNR Panel on Wind and Seismic Effects and to represent NIST in the U.S. National Earthquake Risk Reduction Program. We are planning in further collaborations with Japan that will involve the UJNR Fire Research and Safety and Wind and Seismic Effects Panels. We are working with the Japanese Science and Technology agency to formulate a U.S.-Japan Earthquake R&D Initiative tentatively entitled "Mitigating Urban Earthquake Disasters." A major component would be mitigation and control of post-earthquake fires. The expertise and collaborations of this Panel on Fire Research and Safety should provide strong bases for enhanced collaborations.

As a result of the agreement of our President and Japan's Prime Minister last June, we jointly are planning Earthquake Policy Symposia for the U.S. in September 1996 and Japan in May or June 1997. We expect that the inputs of our panels to these symposia will inform our policy makers of opportunities to substantially reduce U.S. and Japanese vulnerability to conflagrations following earthquakes.

We have benefitted from the many accomplishments of the UJNR Panel on Fire Research and Safety in its twenty-some years of effective collaborations. We are gratified that our Japanese and U.S. colleagues have endured the inconvenience of the postponement of this important meeting and are ready to continue and strengthen our joint efforts to reduce human and economic fire losses. Best wishes for a fruitful meeting.

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OPENING REMARKS

Dr. Yoshio Mimura
Building Research Institute, Japan

Ladies and Gentlemen,

It is a great pleasure to have visited this country again to join the 13th UJNR Panel on Fire Research and Safety.

This meeting was planned to be held last autumn, but because of the U.S. budget problems, it has been postponed until today. Since the Japanese fiscal year is from April to March the next year, if this meeting would have been postponed over April this year, it would have been quite difficult for us to join the meeting. Therefore, we requested the U.S. panel to try to hold the meeting this time here. But I can imagine how much hard work the U.S. panel did to hold the meeting this time. On behalf of the Japanese panel, I would like to extend our deep gratitude and appreciation to Dr. Snell and the U.S. Panel.

Well, as you have known, Japan was shaken and shocked by the Kobe Earthquake last year, and the importance of disaster prevention was recognized. On the other hand, the demands of rationalization of standards and the moderation of restrictions have increased corresponding to the aim of international harmonization.

To meet the needs of an age, it is inevitable to establish the concept of safety as the one which can be evaluated more scientifically and substantially on the basis of internationally common understanding.

In the field of fire research as well as earthquake resistance research, U.S. and Japan are the leading countries in the world. So UJNR should play a more important role from now on.

I certainly wish the fire research of both the U.S. and Japan will be developed much more in the future and the experts in the field of both countries will enhance the mutual understanding as usual and will tighten their collaborative spirit much more to do their mission through the UJNR Panel on Fire Research and Safety of this time.

Thank you very much.

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Each paper is treated like a separate document and may be viewed and/or downloaded that way. The 13th meeting of the U.S.-Japan Panel on Fire Research and Safety was held at the National Institute of Standards and Technology March 13-20, 1996. The core of the meeting consisted of technical sessions on design/risk/hazard/performance standards, burning of real objects, experimental refinement and validation of fire models, suppression, materials testing, detection, and fires after earthquakes. The last of these topics took on special meaning in the wake of two disasters since the 12th meeting: a major earthquake in Northridge, California and the Great Hanshin-Awaji Earthquake on the largest Japanese island of Honshu. In addition, the meeting hosted two one-day Symposia honoring two long-time principals of fire research in general and this UJNR panel in particular. The first was in honor of Professor Edward Zukoski on the occasion of his retirement from the California Institute of Technology. The second was in memory of Professor Kunio Kawagoe of the Building Research Institute and Tokyo Science University.

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