LOG OF MEETING

SUBJECT: Proposed Research Project on the Evaluation of the Effectiveness of Residential Smoke Alarms

DATE OF MEETING: February 16, 1999

DATE OF LOG ENTRY: March 15, 1999

PERSON SUBMITTING LOG: Julie Ayres, Office of Hazard Identification and Reduction

LOCATION: U.S. Consumer Product Safety Commission, Bethesda, MD

CPSC ATTENDEES:

Julie Ayres
James Hoebel
Sandy Inkster
Rikki Khanna
Elizabeth Leland
Hammad Malik
Margaret Neily
Warren Prunella
Ronald Reichel
Linda Smith
Pamela Weller
D. Terry Van Houten

NON-CPSC ATTENDEES:

Tom Barakat	Maple Chase Co.
Tom Brace	National Association of State Fire Marshals
Richard Bukowski	NIST
David Christian	Gentex Corporation
Patrick Coughlin	Operation Life Safety
Mark Devine	First Alert/BRK Brands, Inc.
Scott Edwards	Gentex Corporation
Bob Elliott	Factory Mutual Research Corporation
Ric Erdheim	National Electrical Manufacturers Association
Joseph Fleming	Boston Fire Department
Russell Fleming	National Fire Sprinkler Association, Inc.
William Freeborne	U.S. Department of Housing and Urban Development
Gordon Gillerman	Underwriters Laboratories Inc.
Dan Gottuk	Hughes Associates, Inc.
Larry Grosse	Colorado State University
John Hall	National Fire Protection Association
Deborah Hanson	First Alert/BRK Brands, Inc.
Brian Kadwell	Gentex Corporation
Dan Madrzykowski	National Institutes of Standards and Technology
Kevin McDonald	Sentrol
Rick Mendlen	U.S. Department of Housing and Urban Development
James Milke	University of Maryland
Rick Mulhaupt	The Fire Protection Research Foundation
Soonil Nam	Factory Mutual Research Corporation
Robert Nelson	System Sensor/Pittway
John Ottoson	U.S. Fire Administration
John Pacelli	Gentex Corporation
Paul Patty	Underwriters Laboratories Inc.
Edward Plaugher	Arlington County Fire Department
Larry Ratzlaff	Fyrnetics, Inc.
Henry J. Roux	Roux International, Inc.
Mark Stevenson	National Center for Injury Prevention and Control
Mike Swieboda	First Alert/BRK Brands, Inc.
Mandy Taft	National SAFE KIDS Campaign
Lee Tice	System Sensor/Pittway
Kenneth Venzant	First Alert/BRK Brands, Inc.
Jim Wiemeyer	Pittway Corporation
Soy Williams	International Code Council
Peter Winik	Latham & Watkins representing First Alert
Sara Yerkes	National Fire Protection Association

Summary of Meeting:

NOTE: The following summary only highlights some of the discussion during the meeting. For a full audiotape of the meeting, please contact Rocky Hammond, U.S. Consumer Product Safety Commission, Office of the Secretary, at 301-504-0800 x 1232.

James Hoebel welcomed the participants at 10:00 a.m. and began a presentation that discussed the U.S. Consumer Product Safety Commission (CPSC) proposed research project for FY 2000 to evaluate the effectiveness of residential smoke alarms. The project is intended to test smoke alarms to determine their ability to respond to different types of fire scenarios. Mr. Hoebel indicated that the project is not funded for FY 2000, but due to the complexity of the project, planning at an early stage is essential. Mr. Hoebel continued by explaining that CPSC staff invited interested participants to the meeting to help organize and plan the proposed project.

Mr. Hoebel's presentation showed that the project can have valuable outcomes including demonstrating the capabilities of different types of alarms to respond to serious fire conditions, stimulating the introduction of advanced alarms into the market place, upgrading the applicable standards and codes, and developing appropriate public messages. To accomplish the task, Mr. Hoebel discussed a CPSC staff organization for the project, which included four task groups: the Fire Data Analysis and Evaluation Group, Detector/Sensor Group, Tenability Limits Group, and the Test Development Group.

Linda Smith elaborated on the Fire Data Analysis and Evaluation Group. She indicated the data obtained from this group would feed into the decisions of the Test Development Group. The Data Group would need to answer such questions as:

- What set of fires should the proposed project consider?
- What pieces of information about fire scenarios are important?
- What information is needed? (e.g. what ignited first, what burned, etc.)
- What data are currently available? Will these data be sufficient?

Ms. Smith began a discussion with the participants on the criteria of serious fires to determine the set of fires to evaluate in the testing program. She suggested looking at serious fires that resulted in a death as one possible set. Other participants mentioned other possible data sets including:

- John Hall asked if the group was concerned about all serious health effects and not just death. If that was the case, Dr. Hall suggested that the Task Group evaluate all fires including unreported fires.
- Jim Milke suggested that fires should be detected before fatal and untenable conditions occur. Dr. Milke indicated that the Data Group should look at unwanted fires in a residential setting focusing on the smaller threat because it can quickly become a larger threat.
- Dan Gottuk stated that "growing fires" are the biggest problem and that the proposed project should examine this type of fire in the testing program. He suggested that the program build fire scenarios that lead to undesirable conditions.

- John Hall suggested that we must be able to detect fires in time to save lives. He suggested that the set of fires to evaluate is the range of fires that have the potential to kill people.
- Kenneth Venzant thought the project should consider the full spectrum of fires and treat all of them as very serious. He indicated that all fires could contribute to some type of death. He suggested the proposed project study all fires in all situations.
- Jim Wiemeyer wondered what criteria are used and wanted a more detailed description of a "serious fire" or one that "has the potential to kill".
- Jim Milke indicated we might miss the most frequent fire, a cooking range fire, if we focus only on fatalities. He indicated we must evaluate the spectrum fires that have the potential to develop to more serious situations.

Linda Smith indicated that the set of fires to evaluate would be discussed in more detail during the afternoon Fire Data Analysis and Evaluation Group breakout session.

John Hall made a general comment that the project needed more specifically defined objectives. He asked if the intention of the project was an evaluation tool to assess technology and establish codes and standards, or an examination of existing technology in a number of diverse fires. Dr. Hall recommended a conceptual task group to assist in defining the objectives.

Ms. Ayres stated that the Commission staff would consider the idea of a core concept group to help establish the framework for the proposed project.

Elizabeth Leland continued with an overview of the Detector/Sensor Task Group. She indicated that this Group has the responsibility to determine which detectors are going to be evaluated. The Task Group will identify and develop a plan to gather and compile information on current and new technologies. In addition, the task group will determine criteria for selecting alarms for the testing program.

Ms. Leland started a discussion with the participants by asking about what different types of sensors/detectors might be in the test program. This included comments on the possible inclusion of interconnected detectors, heat detectors, and different types of sensors. Ms. Ayres indicated that "smoke alarms" could include gas sensor technology, heat detectors, or other smart detectors, not just traditional "smoke" alarms.

Hank Roux asked if the Commission is concerned with safety to life or also property damage. Mr. Hoebel indicated that the Commission staff's primary interest is life safety.

Mr. Hoebel led the discussion on the types of dwellings and past research.

- Jay Fleming asked if the focus of testing was on residential settings.
- Dr. Hall wondered if this would stretch into nursing homes or care facilities.
- Scott Edwards emphasized that the proposed project should initially look at residential settings. He stressed the need to examine past research and suggested

looking at research performed by Factory Mutual among others. He stressed that real cooperation of all task groups is needed for the success of the project.

- Dick Bukowski stated that we must look carefully at prior research and study Factory Mutual's testing in an apartment setting. In that testing, Mr. Bukowski indicated that some items mattered and some items did not. In CPSC's testing program, he suggested factoring out items that do not change the results of the outcome.
- Scott Edwards warned that omitting too much might obscure important differences.
- Mark Devine suggested the project examine fatality information to determine settings where a large number of deaths occurred. He also suggested that the Detector/Sensors Task Group should not turn into a research and development project for emerging technologies. We should examine detectors and sensors that are close to being on the market.
- Paul Patty stated that "a fire is a fire" whether it is in an apartment or in an office building. What is important is the tenability limits and if we can measure them. Tenability limits will be the most important item to establish.

Jim Hoebel began a discussion on Tenability Limits with the group by asking Paul Patty about the output of the tenability limits.

- Paul Patty suggested that tenability include the ability to evacuate by examining heat effects, the gases from a fire, the products of combustion of a fire (particles, gases, vapors, temperature) and other information.
- John Hall indicated that the assessment of tenability is about more than the fire and the measurements, but should involve modeling in order to come out with criteria that one can use.
- Jim Milke stated that much of the existing tenability data is based on LC_{50} where we still have half the population dying. He asked how we deal with different toxic elements. Dr. Milke indicated that many tough issues might drive the results of the project.

Jim Hoebel continued the discussion playing "devil's advocate" by asking the rhetorical question of "Why do we even need to specify Tenability Data? Isn't faster just better." We are evaluating the performance of different types of detectors and can examine the tenability after the testing is complete.

- Dan Gottuk objected to the viewpoint that "faster is better," saying one detector may still be sufficient even though it sounded later than another. He suggested that faster detectors may be more prone to nuisance problems.
- Richard Bukowski said that faster is better only if it makes a difference. He noted that Indiana Dunes published all the data so that it could be re-evaluated as new analytical techniques became available.
- John Hall indicated that depending on the tenability criteria applied, the relative performance of detectors could be reversed. Changes in tenability limits may change the detectors. The proposed project must consider tenability limits in advance of any testing program.

- Jay Fleming indicated that the tenability limits in the Indiana Dunes study were based on the evacuation rate. It is important to collect all the data to determine if the range changes from "evacuation possible" to "fatality" conditions. The proposed project should establish criteria that provide adequate egress from the dwelling.
- Hank Roux indicated that the group might be complicating the issue too much. He stated that he wants to know as quickly as possible that he has an unwanted fire, which can be detected by considering the sensitivity of the device and the location.
- Julie Ayres suggested setting ranges for tenability such as (1) egress possible, (2) loss of consciousness, and (3) lethality.
- Many indicated past research exists on tenability and suggested that members of the Tenability Task Group perform a literature review.

Jim Hoebel concluded the discussion of tenability and suggested further discussed in the afternoon session. Mr. Hoebel indicated he would lead the group in the afternoon and noted it would be a temporary leadership assignment.

Julie Ayres began describing how the output of the three task groups will feed into the Test Development Group. The Test Development Group contains four different sub-task groups:

- Furnishing and Configuration Group led by Margaret Neily
- Measurement and Instrumentation Group led by Ron Reichel
- Computer and Bench-top Modeling Group led by Rikki Khanna
- Nuisance Testing Group led by D. Terry Van Houten

The Furnishing and Configuration Group would look at data obtained from the Fire Analysis and Evaluation Group and determine what furnishings and configurations should be used in the testing.

John Hall said that it appears that this group takes input from the other three groups and puts it together as a practical test specification. He again suggested a conceptual overview of the entire project, which would develop the framework for the project to ensure all the elements fit together. Julie Ayres indicated that the Commission staff would consider his proposal.

Julie Ayres explained the second sub-group would be a Measurement and Instrumentation Group, which would look at previous studies to determine:
- The limitations of previous work
- What information and tests are significant
- What was measured
- What information was recorded
- How to use the data recorded

John Hall suggested developing a plan to transform the raw data at the time of testing into a form that could be interpreted. Dr. Hall suggests a task group to make sense of the

measurements. Julie Ayres indicated that members of the Measurement and Instrumentation Group could take on this task.

Julie Ayres explained that the Computer Modeling and Bench Scale Testing Group would look at ways to minimize the full scale testing and look at modeling to assist in the test programs.

Julie Ayres indicated that the last sub-group is a Nuisance Testing Group. The purpose of this group is to see how well the sensors respond when exposed to common nuisance sources. The manufacturing community can develop an alarm that detects quickly but may be prone to nuisance alarms. The goal would be to evaluate how well the detector performs as well as how well they resist nuisance sources.

Tom Brace hoped the group would consider human factors or behavior factors in the research.

Bob Nelson stated that the approach appeared to be a "clean sheet" approach and that the CPSC may never complete its task. Mr. Nelson suggested a task group to look at past literature and testing and analyze the limitations of those tests in order to improve the next tests.

Julie Ayres indicated that it was not our intention to ignore past research and that a thorough literature review was needed.

John Hall suggested including the Tenability Group in the Fire Data Analysis and Evaluation Group. Jim Hoebel indicated that he would consider the suggestion and combined them for the afternoon break-out session.

Jim Hoebel thanked everyone for their valuable comments and invited participants to one of the afternoon break-out sessions to discuss issues in more detail. The morning meeting ended at 11:45 a.m. Participants separated into three Task Groups and reconvened as one group at 3:30 p.m.

At 3:30 p.m. each Task Group leader summarized her each break-out session. The meeting adjourned at 4:00 p.m.

Detector/Sensor Task Group
Break-out Session

Attendees:	
Tom Barakat	Maple Chase Company
Richard Bukowski	National Institute of Standards and Technology
Mark Devine	BRK Brands, Inc./First Alert
Brian Kadwell	Gentex Corporation
Elizabeth Leland	U.S. Consumer Product Safety Commission
Kevin McDonald	Sentrol Corporation
Edward Plaugher	Arlington County (VA) Fire Department
Mark Stevenson	Centers for Disease Control and Prevention
Mandy Taft	National Safe Kids Campaign
James Wiemeyer	Pittway Systems
Peter Winik, Esq.	Latham & Watkins
Sara Yerkes	National Fire Protection Association

Summary of Meeting:

Ms. Leland chaired the meeting. The stated goals of the Task Group are to determine which smoke detector technologies will be evaluated as part of the research project and to select a representative sample of technologies for inclusion in the test program. The Task Group was asked to consider emerging and existing technologies.

The Task Group first identified and discussed the types of technology that currently are available on the market. Among the types of detectors and technologies mentioned were: photoelectric; ionization; combination photoelectric/ionization; system detectors (stand-alone, AC-powered with battery backup, and low voltage supervised panel with battery backup); heat detectors (fixed point and rate of rise); combination carbon monoxide (CO)/smoke detectors; combination heat/smoke detectors; and sprinklers. Of existing technologies, the Task Group felt that the testing program should consider detectors that meet either the 4^{th} or 5^{th} edition of UL 217. In addition, commercial detectors that currently meet UL 268 and are in use in high-end residential applications could be considered. All types of system configurations should be considered.

The Task Group then identified and discussed emerging technologies that possibly could be included in the testing. These included: carbon dioxide (CO_2) detectors; combination smoke/CO detectors in which the smoke and CO detection technologies are connected; combination CO_2/temperature detectors; and "nose-on-chip", spectography, near infrared, far infrared, video (CMOS), acoustic, and filter polarizing technologies.

In a brief discussion of various ways to select a sample, the following ideas were mentioned: ask companies to select a sample from their products, conduct a lottery of all available current and emerging technologies, develop a sample based on sales volume, and develop a sample based on price and product technology features. However, it was then emphasized and agreed to by the Task Group that the purpose of the project was to

evaluate technologies, rather than specific products. Some of the ideas mentioned, therefore, would not be useful in meeting that purpose. Further discussion will occur at future meetings of the Task Group.

The Task Group established the following action items:

- Write a letter to manufacturers of smoke alarms asking them which detectors/types of technology they would like to see tested. The letter would be sent to manufacturers who are members of the Smoke Alarm Project's Task Groups and listees to the Fourth or Fifth Edition of UL 217 to the current edition of UL 268. In addition, the manufacturers would be asked about any emerging technologies of which they were aware -- either from their company's research or from another company's or organization's research activities. Emerging technology, for the purposes of the letter, would be described as technology that was commercially available, with potential applicability to the residential market or technology that already is near-to-market. In addition, the sponsor of the emerging technology should be willing to divulge the information to the public; "black box" technology would not be desirable. The manufacturers would be requested to respond within a month.
- Conduct a literature search into emerging technology.
- Conduct a patent search into emerging technology.

The Task Group established the following timeframe and identified the following individuals as responsible for the action items:

• Prepare letter to be sent to manufacturers	March 1, 1999	E. Leland
• Contact NFPA staff/members for information about emerging technology	March 1999	S. Yerkes
• Contact Oak Ridge (TN) re: spectography	March 1999	E. Plaugher
• Contact Purdue University re: near infrared	March 1999	B. Kadwell

Before the above letter is sent to manufacturers, a draft version will be distributed to Task Group members for their review and comment. The Task Group also talked about contacting the National Electrical Manufacturers Association (NEMA) and UL about information relating to emerging technologies. No assignment was made.

The Task Group agreed to decide when and where to meet again after the above information is received and distributed to Task Group members for their review.

Joint Session
Test Development Task Group/Fire Data Analysis and Evaluation
Break-out Session

Attendees for Test Development Task Group:

Julie Ayres	U.S. Consumer Product Safety Commission
Tom Brace	National Association of State Fire Marshals
Pat Coughlin	Operation Life Safety
Bob Elliot	Factory Mutual Research Corporation
Ric Erdheim	National Electrical Manufacturers Association
Jay Fleming	Boston Fire Department
Russell Fleming	National Fire Sprinkler Association, Inc.
Gordon Gillerman	Underwriters Laboratories Inc.
Dan Gottuk	Hughes Associates, Inc.
Larry Grosse	Colorado State University
Debbie Hanson	First Alert/BRK Brands
Rikki Khanna	U.S. Consumer Product Safety Commission
Hammad Malik	U.S. Consumer Product Safety Commission
Dan Madrzykowski	National Institutes of Standards and Technology
Soonil Nam	Factory Mutual Research Corporation
Margaret Neily	U.S. Consumer Product Safety Commission
John Ottoson	U.S. Fire Administration
John Pacelli	Gentex Corporation
Paul Patty	Underwriters Laboratories Inc.
Warren Prunella	U.S. Consumer Product Safety Commission
Larry Ratzlaff	Fyrnetics, Inc.
Ronald Reichel	U.S. Consumer Product Safety Commission
Lee Tice	System Sensor/Pittway Corporation
D. Terry Van Houten	U.S. Consumer Product Safety Commission
Kenneth Venzant	First Alert/BRK Brands, Inc.

Attendees for Fire Data Analysis and Evaluation:

Dave Christian	Gentex Corporation
Scott Edwards	Gentex Corporation
Bill Freeborne	U.S. Department of Housing and Urban Development
John Hall	National Fire Protection Association
James Hoebel	U.S. Consumer Product Safety Commission
Sandy Inkster	U.S. Consumer Product Safety Commission
Rick Mendlen	U.S. Department of Housing and Urban Development
Rick Mulhaupt	The Fire Protection Research Foundation
Robert Nelson	Pittway Corporation
Hank Roux	Roux International, Inc.
Linda Smith	U.S. Consumer Product Safety Commission, Group Leader
Mike Swieboda	First Alert/BRK Brands, Inc.
Mandy Taft	National SAFE KIDS Campaign
Soy Williams	International Code Council

Summary of Meeting:

Ms. Ayres chaired the meeting with a joint session between the Test Development Group and Fire Data Analysis and Evaluation/Tenability Group. The joint session began to establish what information is important to obtain about fires when evaluating the data. Members of the joint group explained many items are important such as: what ignited, room of origin, spread factors, ceiling height, type of dwelling, ignition source, layout of building, and means of egress.

Some participants cautioned that it is too hard to examine the large number of possible configurations and that many characteristics are important. To attempt to encompass many of the situations, it was suggested to attempt to put upper and lower limits in the testing plan.

Participants emphasized the need to focus on residential fire settings for the proposed project.

A discussion on the importance of establishing tenability criteria for the project was highlighted. The group defined tenability as whether notification occurred before untenable conditions occurred taking into account the time needed to escape. Measurements such as CO, smoke obscuration and HCN were suggested to determine if untenably occurs before or after activation of the alarm.

Members of the Task Groups focused on specific testing parameters. These included the origin of the fire (kitchen, living room, and bedroom), the spread of the fire (smoldering, smoldering to flaming, and flaming) and the materials (plastic, cellulose, and foam). Participants suggested looking at past research to help to define the scope of the testing program.

At this point, the Fire Data and Evaluation Task Group began separate discussions.

Fire Data Analysis and Evaluation Task Group
Break-out Session

Attendees:

Dave Christian	Gentex Corporation
Scott Edwards	Gentex Corporation
Bill Freeborne	U.S. Department of Housing and Urban Development
John Hall	National Fire Protection Association
James Hoebel	U.S. Consumer Product Safety Commission
Sandy Inkster	U.S. Consumer Product Safety Commission
Rick Mendlen	U.S. Department of Housing and Urban Development
Rick Mulhaupt	The Fire Protection Research Foundation
Robert Nelson	Pittway Corporation
Hank Roux	Roux International, Inc.
Linda Smith	U.S. Consumer Product Safety Commission, Group Leader
Mike Swieboda	First Alert/BRK Brands, Inc.
Mandy Taft	National SAFE KIDS Campaign
Soy Williams	International Code Council

Also interested:

Larry Ratzlaff	Fyrnetics

Summary:

It was agreed that, for now, the task group would concentrate on determining the most common fire scenarios described in NFIRS. The issue of whether information that is not available from NFIRS was not resolved at this meeting.

It was agreed that it is important to evaluate data on residential fires where people live (1 and 2 family dwellings and apartments). Data will be produced on all fires, fires with deaths, and fires with injuries.

The focus of evaluation will be on the causes of fires. Data will be evaluated to select 2-3 scenarios involving areas of origin and product (defined by material ignited) combinations. Other features to be considered are rates of fire growth (based on form of heat and item ignited) and housing type (one and two level houses, apartments, and manufactured homes). HUD indicated they would consider support for testing of manufactured homes.

John Hall will begin working on the data to develop a draft by the end of March. CPSC, and possibly USFA, will provide input to the analysis. When the draft is complete, it will be distributed to the rest of the task group for comment.

Test Development Task Group
Break-out Session

Attendees for Test Development Task Group:

Julie Ayres	U.S. Consumer Product Safety Commission
Tom Brace	National Association of State Fire Marshals
Pat Coughlin	Operation Life Safety
Bob Elliot	Factory Mutual Research Corporation
Ric Erdheim	National Electrical Manufacturers Association
Jay Fleming	Boston Fire Department
Russell Fleming	National Fire Sprinkler Association, Inc
Gordon Gillerman	Underwriters Laboratories Inc.
Dan Gottuk	Hughes Associates, Inc.
Larry Grosse	Colorado State University
Debbie Hanson	First Alert/BRK Brands
Rikki Khanna	U.S. Consumer Product Safety Commission
Hammad Malik	U.S. Consumer Product Safety Commission
Dan Madrzykowski	National Institutes of Standards and Technology
Soonil Nam	Factory Mutual Research Corporation
Margaret Neily	U.S. Consumer Product Safety Commission
John Ottoson	U.S. Fire Administration
John Pacelli	Gentex Corporation
Paul Patty	Underwriters Laboratories Inc.
Warren Prunella	U.S. Consumer Product Safety Commission
Larry Ratzlaff	Fyrnetics, Inc.
Ronald Reichel	U.S. Consumer Product Safety Commission
Lee Tice	System Sensor/Pittway Corporation
D. Terry Van Houten	U.S. Consumer Product Safety Commission
Kenneth Venzant	First Alert/BRK Brands, Inc.

Summary of Meeting:
Ms. Ayres continued the discussion with the Test Development Task Group on various phases of the project. These included computer modeling, small-scale testing, full-scale testing, nuisance alarm testing, and measurements. The group discussed ways to bound the testing program to look at extremes

Ms. Ayres led a discussion with participants on how to use small-scale tests to minimize the need for full-scale tests. One participant suggested using controlled conditions to test multiple rooms with varying geometry and compare the detectors with well controlled, repeatable fuels. In this type of test series, the project could develop and verify the test model. Then full-scale tests with an actual home, furnishings and various types of detectors can be used to complete the series. Others suggested using small-scale testing (e.g. a wind tunnel) to assist in evaluating what matters and omitting those parameters that have no effect on activation. That would assist in prediction of activation. Others suggested a harden test areas for repeat fires.

The participants emphasized that many items were important criteria in the testing, and mentioned; materials, particle size (quality of smoke), air flow, smoke color, fire growth, heat, etc.

A brief discussion on nuisance alarm testing took place. This included emphasizing the importance of this segment of the program. Future meetings will address the testing of nuisance sources and ways to address it in the testing program.

The Task Groups main goals were to agree on:

- a method of measurement
- levels of tenability
- what measurements to take
- how to measure
- how to utilize existing models
- how to test for nuisance alarms

Participants suggested developing a strawman document and having the members of the Task Group review the document. After the strawman is distributed to the Task Group members for review, the next meeting date will be set. Julie Ayres agreed to develop the strawman document.