The preliminary test matrix includes the following variable co

- Fluid
  - gasoline spill of varying amounts
  - stand of clothing saturated with gasoline
- Variable ventilation
- Simulated body movement
- Variable water heater height
- Variable operation of water heater
  - off with simulated draft
  - pilot only on
  - fully ignited

A preliminary matrix has been developed for the experimental

Test #	Plan	Room Size	Soak/Spill		Ventilation		Movement		WH Height		
			Soak	Spill	Low	High	Yes	No	Level	18"	C
1	C	Large		L	X			X	X		X
2				L	X			X	X		
3				L		X		X	X		X
4				L		X		X	X		
5				L		X		X	X		
6				L	X			X		X	X
7				L	X			X		X	
8				L	X			X		X	
9				L		X		X		X	X
10				L		X		X		X	
11				L		X		X		X	
12				V	X			X	X		X
13				V	X			X	X		
14				V	X			X		X	X
15				V	X			X		X	

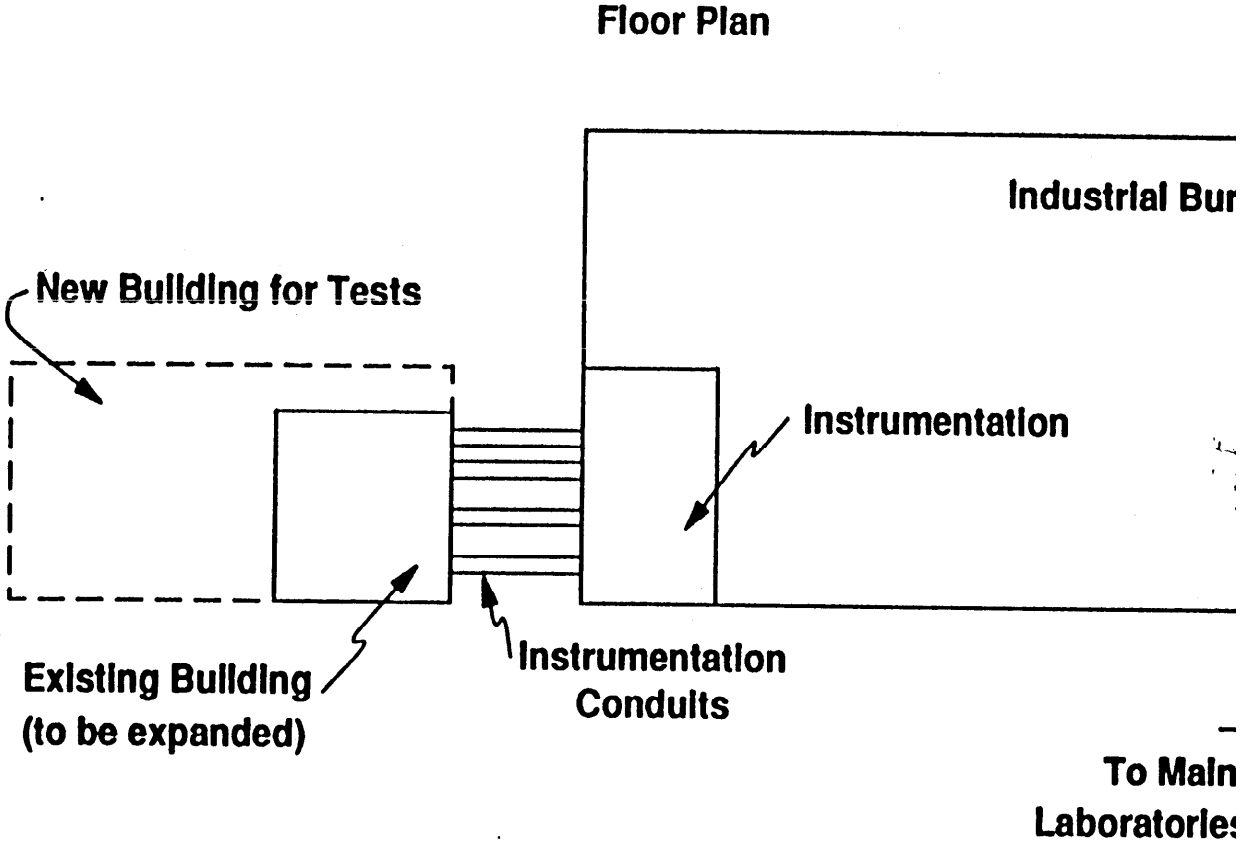
Experimental Testing Task Test Plan (continued)

Test #	Plan	Room Size	Soak/Spill		Ventilation		Movement		WH Height		
			Soak	Spill	Low	High	Yes	No	Level	18"	
16				V	X			X		X	
17			X		X		X		X		
18			X		X		X		X		
19			X		X		X		X		
20			X		X		X			X	
21			X		X		X			X	
22			X		X		X			X	
23	B	Med		S	X			X	X		
24				S	X			X	X		
25			X		X		X		X		
26			X		X		X		X		
27			X		X		X		X		
28	A	Small		S	X			X	X		
29				S	X			X	X		
30				S	X			X	X		
31			X		X		X		X		
32			X		X		X		X		
33			X		X		X		X		

The American Gas Association Laboratories were chosen for location.

- A purchase order is being issued to use the facilities.
- Instrumentation is being calibrated.
- Tests will begin before the end of February and last approxim weeks

A building is being modified at the American Gas Association Laboratories to accommodate testing.



Experimental Testing Task Test Status

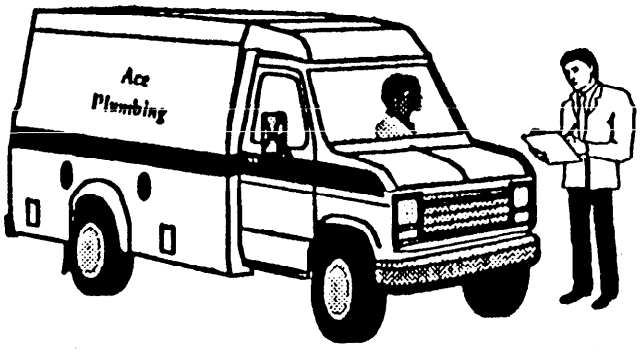
The preliminary Experimental Plan is completed, and a test si selected. The following tasks remain:

- Execute test plan
- Coordinate with analytical modeling to understand and define dispersion and ignition of flammable vapors
- Summarize results

Survey Task

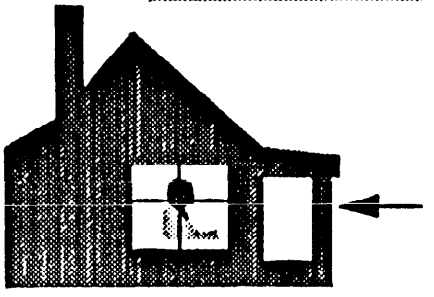
In Task 3 we originally proposed to identify opportunities in t which could lead to reduced incidents of flammable vapor ig

Installer Interviews



- Current installation practices
- Awareness of codes
- Extent of compliance

Consumer Inter



- Current installatio
- Awareness of war
- Ideas for educatio
  - What currentl
  - What could w

We have completed preliminary field research.

RC42238-30

Arthur D Little

Survey Task

Based on the accelerated launch of the media campaign, GA wish to delay completion of this task until the experimental complete.

- ✔ The number of possible problems makes it difficult to focus a broa
  - Codes may be wrong
  - Codes may not be enforced
  - Consumer behavior may be prime problem
  - Installers may be unawar
  - Installer may be homeow

- ✔ Focus should reflect working hypotheses on
  - What actually goes wrong
  - Potential solutions

- ✔ Incident reports were not clear enough to provide a meaningful fo goes wrong

- ✔ Experimental testing may suggest possible reasons and potential thereby providing the necessary focus for survey effort

RC42236-

Arthur D Little

Effort could be redirected to:

1. Validate primary public relations initiatives.

2. Prioritize and focus secondary PR efforts.
   - TV education campaigns may not be enough

3. Measure effectiveness of current efforts.

4. Build and maintain a database to chart progress on improvement.

5. Solocit new ideas for targeted promotion

Appendix A: List of Documents Reviewed for the Data Collection and Analysis Task of the Ignition of Flammable Vapors by Gas Water Heaters Study for GAMA

Doc. #	Document Title/Summary	Source of Document	Date
1	Investigation Guideline	CPSC	8/27/82
2	Inv. Guideline, App. 22	CPSC	12/29/85
3	CPSC Position Paper	CPSC	3/6/92
4	Summary of Model Bldg Code by state	GAMA	
5	Uniform Coding for Fire Protection, pg 901-98 to 901-102	GAMA	
6	1989 Incident file, USFA data, sorted by state & room of origin	GAMA	
7	1988 Incident file, USFA data, sorted by state & room of origin	GAMA	
8	1987 Incident file, USFA data, sorted by state & room of origin	GAMA	
9	Consumer and Corporate Affairs, Canada: Hazardous Products Act Amendment re Flammable Adhesives	GAMA	7/3/90
10	The National Estimates Approach to U.S. Fire Statistics (Harwood and Hall)	GAMA	5/89
11	ANSI Z21 Committee memo	GAMA	9/16/92
12	CPSC Epidemiologic In-Depth Investigation Report (Case # 770426BLP7002 (??hard to read??))	GAMA	5/3/77
13	CPSC In-Depth Investigation Report (Case # 910319HWE5017)	GAMA	5/14/91
14	CPSC In-Depth Investigation Report (Case #890626WES5011)	GAMA	10/2/89
15	CPSC In-Depth Investigation Report (Case #910319HWE5017) (same case as doc #13, but more detail)	GAMA	5/13/91

16	CPSC In-Depth Investigation Report (Case #910329HCN0872)	GAMA	5/13/91
17	CPSC In-Depth Investigation Report (Case # 881209HCC2037)	GAMA	2/21/89
18	CPSC In-Depth Investigation Report (Case # 901001HCC2330)	GAMA	1/10/91
19	CPSC In-Depth Investigation Report (Case #840612ATL5072)	GAMA	7/20/84
20	CPSC In-Depth Investigation Report (Case #910913HCC2277)	GAMA	12/19/91
21	CPSC In-Depth Investigation Report (Case #850314NYC4083)	GAMA	5/6/85
22	CPSC In-Depth Investigation Report (Case #751015BEP0008)	GAMA	(approx) 11/75
23	CPSC In-Depth Investigation Report (Case # 881213HCC1167)	GAMA	2/3/89
24	CPSC In-Depth Investigation Report (Case # 881122HCC2034)	GAMA	2/13/89
25	CPSC In-Depth Investigation Report (Case # 910329HWE5021)	GAMA	5/7/91
26	CPSC In-Depth Investigation Report (Case # 840208HCC3140)	GAMA	3/13/84
27	CPSC In-Depth Investigation Report (Case # 840313CBC3114)	GAMA	3/30/84
28	CPSC In-Depth Investigation Report (Case # 880318CCC0228)	GAMA	5/9/88
29	CPSC In-Depth Investigation Report (Case # 910806HCC0281)	GAMA	9/24/91
30	CPSC In-Depth Investigation Report (Case # 830425BEP0001)	GAMA	5/20/83
31	CPSC In-Depth Investigation Report (Case # 830323DAL5054)	GAMA	4/27/83
32	CPSC In-Depth Investigation Report (Case # 830323DAL4070)	GAMA	5/83

33	CPSC In-Depth Investigation Report (Case # 821020ATL5007)	GAMA	11/23/82
34	CPSC In-Depth Investigation Report (Case # 821004WES0005)	GAMA	11/15/82
35	CPSC In-Depth Investigation Report (Case # 820831HIA1323)	GAMA	10/12/82
36	CPSC In-Depth Investigation Report (Case # 820611HIA2331)	GAMA	7/19/82
37	CPSC In-Depth Investigation Report (Case # 900425HCC2130)	GAMA	7/17/89
38	CPSC In-Depth Investigation Report (Case # 820722HIA1286)	GAMA	9/7/82
39	CPSC In-Depth Investigation Report (Case # 820714HIA2358)	GAMA	8/16/82
40	CPSC In-Depth Investigation Report (Case # 890424WES5008)	GAMA	6/2/89
41	CPSC In-Depth Investigation Report (Case # 910204HCC1131)	GAMA	4/2/91
42	CPSC In-Depth Investigation Report (Case # 840816HCC3377)	GAMA	10384
43	CPSC In-Depth Investigation Report (Case # 910917HCC1422)	GAMA	12/26/91
44	CPSC In-Depth Investigation Report (Case # 890410HCC2122)	GAMA	7/17/89
45	CPSC In-Depth Investigation Report (Case # 910619HCC2220)	GAMA	11/15/91
46	CPSC In-Depth Investigation Report (Case #910807HCN1878)	GAMA	8/28/91
47	CPSC In-Depth Investigation Report (Case # 830608BEP0007)	GAMA	6/23/83
48	CPSC In-Depth Investigation Report (Case # 911209HCC1500)	GAMA	2/14/92
49	CPSC In-Depth Investigation Report (Case # 801222ATL0386)	GAMA	2/26/81

50	CPSC In-Depth Investigation Report (Case # 770906BEP7002)	GAMA	10/13/77
51	CPSC In-Depth Investigation Report (Case # 771103BEP0002)	GAMA	11/22/77
52	CPSC In-Depth Investigation Report (Case # 791116HIA0113)	GAMA	12/26/79
53	CPSC In-Depth Investigation Report (Case # 911203HCC2038)	GAMA	1/31/92
54	CPSC In-Depth Investigation Report (Case # 810625CEP1237)	GAMA	8/81
55	CPSC In-Depth Investigation Report (Case # 910610HCC2044)	GAMA	8/91
56	CPSC In-Depth Investigation Report (Case # 910320HCC2104)	GAMA	8/8/91
57	CPSC In-Depth Investigation Report (Case # 820126HIA3040)	GAMA	4/26/82
58	CPSC In-Depth Investigation Report (Case # 820419HIA2266)	GAMA	6/82
59	CPSC In-Depth Investigation Report (Case # 820527HIA3113)	GAMA	7/19/82
60	Proposal for a Homeowner Water Heater Safety Awareness Program	Loran Nordgren	6/22/92
61	Uniform Fire Code, 1988	AGA Labs	1988
62	GATC 1990 Program: Task on Water Heating Issues: Water Heaters Installed in Garages	AGA Labs	6/91
63	Water Heaters and Flammable Vapors (by Gauthier & Murphy)	Kolman and Murphy	
64	Tech. Comm. Rpts., Log #20, NFPA 54-A92TCR	NFPA	
65	Tech. Comm. Rpts., Log #27, NFPA 54-A92TCD	NFPA	
66	CPSC IDI, case #910605HCC0242	GAMA	6/12/91

67	County of LA Fire Dept., w/attachments re garage fires	L. Kolman	11/27/74
68	So. Cal. Gas Co.: Re: Hearing on fuel Burning Appliances in Private Garages	L. Kolman	8/15/74
69	County of LA: Synopsis of Minutes of Public Hearing on Fuel Burning Appliances in Private Garages	L. Kolman	8/23/74
70	GAMA: Results of GAMA Review of Residential Gas Appliance Standards	L. Kolman	3/4/82
71	Calspan Tech Rpt: Investigation of Safety Stds for Flame Fired Furnaces, Hot Water Heaters, Clothes Dryers, and Ranges	L. Kolman	9/3/80
72	Ed Heiden resume	L. Kolman	
73	Statistical Abstract of the U.S.: excerpts from Heiden	L. Kolman	
74	List of Sources for Research Exhibits, from Heiden	L. Kolman	
75	Nat'l Sporting Goods Assoc. Research: Sports Participation in 1987	L. Kolman	12/16/88
76	NTSB: Annual Review of Accident Data, CY1984, from Heiden	L. Kolman	
77	CPSC Memo.: ATV Project Comparative Injury Tables, from Heiden	L. Kolman	6/13/86
78	"Review of the Record", John F. Morrall III; from Heiden	L. Kolman	11/86
79	Viewgraphs on Fire data; from Heiden	L. Kolman	?
80	NEISS output: all products CY1981, from Heiden	L. Kolman	6/3/82
81	CPSC: Death Certificate Summary Report, CY82; from Heiden	L. Kolman	6/20/86
82	The Nat'l Estimates Approach to U.S. Fire Statistics, Harwood & Hall	L. Kolman	5/89
83	NEISS: CY79 to 11/14/88, Injury Info. for Numerous Products, from Heiden	L. Kolman	

84	CPSC IDI, case #840820HCC1334, from Heiden	L. Kolman	8/12/84
85	Nat'l Federation Handbook, 1986-87, sports participation, from Heiden	L. Kolman	
86	Statistics on participation in various activities, from Heiden	l. Kolman	
87	"Risk/Benefit Analysis", Crouch and Wilson	L. Kolman	1982
88	NFIRS data format info.; from Heiden	L. Kolman	3/21/88
89	data on motor vehicle accidents; from Heiden	L. Kolman	
90	Fire info viewgraphs; from Heiden	L. Kolman	
91	fire info viewgraphs; from Heiden	L. Kolman	
92	"Special Report Residential Structure Fires Involving Flammable combustible Liquids, 1980-84" by Kenneth Taylor at NFPA	L. Kolman	7/87
93	data (notes) on various sports; from Heiden	L. Kolman	
94	Transcripts of trial Thomas versus State Ind.	L. Kolman	
95	Excerpts for historical studies of the Gas Utility Industry, 1976-1985	R. Topping	c 1987
96	Bradford White Waterheaters-Durable standard (product literature) & Field Service Bulletin	R. Topping from GAMA utility	11/20/92
97	AGA Engineering Technical Note: "Warning Tags and Generic Safety Symbols for Consumers"	R. Crooker (ADL)	11/24/92
98	Calspan Report: "Identification and Classification of Potential Hazards Associated with the use of Residential Flame Fired Furnaces, Hot Water Heaters, Clothes Dryers and Ranges"	GAMA	11/30/92
99	Excerpts of Appliance shipping data from April 91 "Appliance" magazine	R. Topping	12/92

100	NFPA: Backup documentation from FIDO incidents	NFPA	12/92

Arthur D Little

Flammable Vapor Hazards Ignition Study

Presentation to GAMA
Consumer Information
and Education
Committee
Water Heater Division
April 25, 1993

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[redacted]

Minutes of Meeting

of

WORKING GROUP ADDRESSING SUGGESTED REVISIONS TO REDUCE POSSIBLE IGNITION OF FLAMMABLE VAPORS BY VOLUME I WATER HEATERS

(A working group of the Z21 water heater subcommittee)

March 17-18, 1992

(Minutes of March 17-18, 1992 Meeting of Working Group Addressing Suggested Revisions to Reduce Possible Ignition of Flammable Vapors by Volume I Water Heaters)

LIST OF SUBJECTS

LIST OF SUBJECTS (continued)

Minutes of Meeting

of

WORKING GROUP ADDRESSING SUGGESTED REVISIONS TO REDUCE POSSIBLE IGNITION OF FLAMMABLE VAPORS BY VOLUME I WATER HEATERS

(A working group of the Z21 water heater subcommittee)

Held at the
Maxwell House Hotel
2025 MetroCenter Boulevard
Nashville, Tennessee

March 17-18, 1992

The meeting was called to order by the Acting Chairman at 9:00 A.M., Central Standard Time, Tuesday, March 17, 1992. During the course of the meeting, the following were in attendance:

Members Present or Represented:

Daryl L. Hosler, Southern California Gas Co. **(ACTING CHAIRMAN)**
Joe A. Akin, Jr., Alabama Gas Corp.
Joseph Z. Fandey, U.S. Consumer Product Safety Commission
William T. Harrigill, Water Heater Division, Rheem Manufacturing Co.
Jay R. Katchka, Grayson Controls Division, Robertshaw Controls Co.
Eric M. Lannes, Bradford-White Corp.
David Lasseter, State Industries, Inc.
Henry Jack Moore, American Appliance Mfg. Corp.
(represented by Jerry Miller, Mor-Flo Industries, Inc.)
James Ranfone, American Gas Association
John Scime, A. O. Smith Water Products Co.
Frank A. Stanonik, Gas Appliance Manufacturers Association
Ernest Wenczl, State Industries, Inc.
Larry L. Westling, Northwest Natural Gas Co.

Administrative Staff (Non-voting):

David C. Bixby

During the course of the meeting, sessions were held as follows:

March 17	9:00 A.M. - 4:45 P.M.
March 18	8:30 A.M. - 11:00 A.M.

[STAFF NOTE: The record of the discussions and actions of the working group taken at this meeting are reported in a manner to achieve continuity of thought and, therefore, may not appear

in the precise order in which they occurred during the meeting.]

OPENING REMARKS

Chairman Hosler briefly reviewed the background of his January 13, 1992 meeting announcement letter to the working group. He stated that at its November 1991 meeting, the Z21 water heater subcommittee heard a presentation from Mr. Edward F. Downing, III regarding flammable vapor ignition incidents and gas-fired water heaters. After his presentation, Mr. Downing had proposed the following new provision, 1.4.6, be added to the Volume I water heater standard (Z21.10.1):

> "1.4.6 The construction of a water heater, other than direct vent water heater, shall be such that when installed the combustion air supply will not be taken immediately from a level below 18 inches from the floor of the room in which the appliance is installed."

Mr. Downing had also provided a three page rationale statement in support of his proposal.

Chairman Hosler noted that a primary task of the subcommittee's working group is to evaluate Mr. Downing's proposal, including Mr. Downing's rationale and data, and present this evaluation for consideration by the water heater subcommittee.

In addition, Chairman Hosler commented that U. S. Consumer Product Safety Commission (CPSC) Staff had provided the working group with further data on water heater/flammable vapor incidents. Under letter dated March 6, 1992, CPSC Staff had provided the Z21 Secretariat with a "Position Paper on a Standard for Gas Water Heaters to Prevent Ignition of Flammable Vapors," dated February 1992. The CPSC Position Paper had been prepared by the "CPSC Working Group on Gas Voluntary Standards." The above CPSC correspondence had been forwarded by staff to this working group under letter of March 9, 1992.

REVIEW OF CPSC POSITION PAPER ON A STANDARD FOR GAS WATER HEATERS TO PREVENT IGNITION OF FLAMMABLE VAPORS

At this time, the working group reviewed and discussed the "Position Paper on a Standard for Gas Water Heaters to Prevent Ignition of Flammable Vapors," dated February 1992, prepared by the "CPSC Working Group on Gas Voluntary Standards."

CPSC Staff in attendance stated that the Z21 water heater subcommittee is not under any mandate from the CPSC to facilitate a water heater design change to address this problem. It was noted other possible methods to reduce ignition of flammable vapors might also be discussed and considered.

CPSC Position Paper Overview

It was commented that the February 1992 Paper presents the CPSC staffs' position that a voluntary standard performance test should be developed to prevent ignition of flammable vapors by gas-fired water heaters. The CPSC position is based in part on an April 4, 1991 meeting with CPSC staff and Mr. Edward F. Downing, III. Mr. Downing's presentation and recommendations were similar to those he had presented at the water heater subcommittee's November 1991 meeting. The CPSC position is also based on a subsequent staff review of all available data on the subject.

In support of its position, the CPSC Position Paper contains several U.S. Government memorandums from several CPSC departments. It was noted that the CPSC internal memos were all formulated from the same fire data information. It was pointed out that the CPSC internal memos attached to the Position Paper were a result of a CPSC staff meeting in response to the establishment of this working group to address Mr. Downing's proposal and rationale.

CPSC Internal Memo from Directorate for Epidemiology

The CPSC internal memo from the Directorate for Epidemiology provided 1989 estimates of fire deaths, injuries, and property loss from flammable vapors ignited by water heaters. According to the Directorate for Epidemiology, 12 deaths, 374 injuries, and 19 million dollars in property damage was reported to have occurred in 1989, the most recent year for which data are available. This estimate included deaths, injuries, and property damage associated with the ignition of flammable vapors by gas-fired water heaters. The source for the CPSC estimate was data obtained from the National Fire Protection Association (NFPA) and is based on the National Fire Incident Reporting System (NFIRS). NFIRS is a national fire reporting system operated by the U.S. Fire Administration and Federal Emergency Management Agency.

CPSC Internal Memo from Directorate for Economic Analysis

The CPSC internal memo from the Directorate for Economic Analysis contained estimated benefits associated with the prevention of deaths, injuries and property damage relating to accidents involving flammable vapor ignition by gas-fired water heaters. The Directorate for Economic Analysis had used the annual average numbers of deaths and injuries associated with such accidents based on the above 1989 data from the Directorate for Epidemiology, and a Special Report prepared by the NFPA in 1987 based on NFIRS data from 1980 - 1984. The NFPA 1987 Special Report, Residential Structure Fires Involving Flammable, Combustible Liquids 1980 - 1984 Fire Experience, was prepared by Mr. Kenneth T. Taylor, NFPA. Analysis for this report used national estimates based on fire incident data reported to the NFPA annual survey and the NFIRS. National estimates of fires and associated losses were based on statistical methods developed by analysts from the NFPA, the U.S. Fire Administration, and the CPSC. All analysis were guided by NFPA Standard 901, Uniform Coding for Fire Protection, 1976 edition. The 901 Standard provides a common fire reporting language used widely throughout the U.S. by the fire service. The NFPA 1987 Fire Report had been forwarded to the working group prior to its meeting.

The Directorate for Economic Analysis estimation of the benefits considered the severity of burns involved with such accidents. It also considered that three-fourths of current annual water heater production, estimated at 3.9 million units, is for replacement and one-fourth for new construction.

The CPSC economic report concluded that if the entire production of gas water heater installations could be affected, and if the changes were 100 percent effective, injury reduction could accumulate at the rate of up to 2 deaths, 30 injuries and 1.2 million dollars in property damage each year. The memo concluded that the estimated benefit expected per household could total 40 to 60 dollars over the expected 11-year life of the gas-fired water heater.

CPSC Internal Memo from Human Factors Division

The CPSC internal memo from the Human Factors Division examined the possible effectiveness of labeling for preventing such injuries and concluded that a warning label will not eliminate the hazard. However, it noted that since raising the water heater to a desired height will not eliminate the potential for the ignition of flammable vapors, consumers are still at risk and need to be warned of the potential hazard.

During review of the CPSC Paper, it was noted that CPSC Staff's March 6, 1992 cover letter appears to imply that the working group/subcommittee is to develop test requirements and standards to address the issue of flammable vapor ignition by gas water heaters. Chairman Hosler commented that, contrary to the above implication, the working group's present task is to review the available material/data and determine if such coverage is warranted, as outlined in his January 30, 1992 meeting announcement letter to the working group.

The 18-inch Height Specification

It was noted that the second paragraph of CPSC Staff's March 6, 1992 cover letter recommends testing a "standard" water heater in an essentially draft free room at an elevation of approximately 18 inches as a desirable goal.

It was discussed if the water heater itself should be elevated 18 inches, or should its combustion air inlet be at an 18 inch elevation. It was commented that the National Fuel Gas Code (ANSI Z223.1/NFPA 54) specifies that "burners and burner ignition devices" shall be not less than 18 inches off the floor. In light of this, it was noted that the height of the burner and burner ignition source is the primary concern, rather than the height of the combustion air inlet. Mr. Downing (and CPSC) had advocated the 18-inch specification pending further research to validate the 18-inch height, or determine if another height is more appropriate and effective.

It was pointed out that useful information on determining an appropriate height can be obtained by using instrumentation which responds to combustible mixtures in draft free and non-draft free environments. It was noted that such research should include the affects on flammable vapors by the movements of persons, drafts, etc. Such factors may influence flammable vapor movement

and intensity which may lead to the premise that the 18-inch height rule is not valid for preventing ignition of flammable vapors in certain situations.

It was discussed if it can be determined that all combustion air can be taken from a specific height of 18 inches. It was commented that flammable vapors can be present 12 inches off the floor only to be pulled into an 18-inch high combustion air inlet by the draft caused when a water heater operates.

It was suggested that the available data needs further evaluation, in addition to gathering and evaluating further data, before the working group can determine if the 18 inch height rule is appropriate.

Suggested Means of Prevention

The end of the CPSC Paper's "Conclusion" stated that "subsequently, it will be necessary to devise a test method whereby non-height related fixes can be evaluated and certified." Mr. Fandey indicated that this statement recognizes other solutions to the problem (validated by a performance test), in lieu of raising the combustion air inlet to an 18 inch height.

Mr. Fandey noted that one possible means of prevention for existing installations could employ a "dam" around the water heater so that combustion air has to be taken from 18 inches off the floor. A member questioned whether employing such a "dam" for existing installations would be interpreted as an equivalent means to elevating the water heater 18 inches off the floor.

Mr. Fandey also noted that special screens have been suggested that may be adaptable to filter out the flammable vapors to reduce such incidents. It was pointed out that such screens can be blocked, damaged, etc., and are not thought to be a feasible solution. It was reported that CPSC intends to investigate and test all possible means of prevention to determine what is feasible in the future.

Available Fire/Accident Data

It was noted that the fire data reported by CPSC on this subject involves the time period between 1980 and 1984, with more recent data from 1989. It was pointed out that the available data predates an injury reduction means now in place. Such a means is the flammable vapors warning label implemented by water heater manufacturers during 1989. A similar label is specified in the Volume I water heater standard, ANSI Z21.10.1a-1991. It was suggested that current accident data should be obtained to determine the effectiveness of this warning label on water heaters.

It was suggested that the available data on injuries/deaths associated with such accidents be examined based on the increase of water heaters per capita.

It was commented that the CPSC's memo regarding 1989 accidents indicated 9 out of 12 fire deaths attributable to gasoline vapor ignition. It was noted that the specific locations of such accidents should be obtained to determine how many fire deaths took place in a garage, as opposed to other locations.

It was questioned whether the available fire data can be divided into regions of the U.S., or if it should be interpreted as pertaining to all areas of the U.S. It was noted that if the available data could be divided regionally, the regions could be further evaluated by how their applicable model or gas codes address water heater installations in garages, etc. If this type of data were available it could be determined if the region's applicable code(s) is adequate and enforceable as a viable means of addressing such accidents.

It was noted that the NFIRS data is only as good as its source, and the data should be interpreted by trained individuals. It was also noted that the current fire reporting procedures do not provide for a regional breakdown of the available data. It was commented that CPSC Staff is well qualified in this respect and participates directly with the NFIRS/NFPA organization to properly interpret the NFIRS fire data.

It was commented that the 1987 NFPA Special Report (1980 - 1984) specifies the "area of fire origin." It was pointed out that the origin of fires in living spaces do not indicate if fires were of gasoline origin and that the data is not complete enough to indicate the cause of fires in these living locations.

It was commented that the end of the NFPA Report references "leading indicators of residential structure fires involving flammable, combustible liquids" (1980 - 1984). This part of the report indicated that the primary location for the origin of reported fires was the "garage, carport, and vehicle storage areas." Furthermore, the leading indicators noted that "fuel" was the primary form of material first ignited.

Several members commented that the available fire data does not appear to be sufficient to support a conclusion that the water heater is the primary cause of flammable vapor ignition accidents.

Proper Education on Flammable Vapor Hazards

Several members commented that a substantial education program is needed to instruct consumers on the dangers of improper use or storage of gasoline. Most in attendance indicated that consumer education is needed to keep gasoline and other flammable liquids out of the reach of children, and to teach appropriate means for handling such flammable liquids.

It was questioned whether the CPSC staff recommendations of a design change would eclipse or preclude an effective education program on such hazards. It was noted that CPSC Staff is not implying that the new water heater warning label and the information/education program is not needed if a design change is substantially effective. It was pointed out that CPSC Staff is to continue with its previous plan to do an education and information project on the subject of flammable vapor ignition. It was clarified that Mr. Downing's April 1991 presentation to CPSC Staff had influenced the staff to forward its current recommendation that some type of design change (proven by performance testing) is now needed to address the concern. It was reported that this subject will become a CPSC priority project for 1994, but funding is now being sought by CPSC to conduct appropriate research testing on water heaters for this year (1992).

It was noted that if the level of education level is increased, it will improve the present situation and affect the issues involved with a suggested water heater design change.

It was pointed out that several gas utility areas in the U.S. have education programs on the subject of flammable vapor ignition. It was reported that some gas utilities are placing the new flammable vapors warning label on existing water heaters in the field. In some cases, an attempt is made to notify the consumer of the reason for putting such a label on their water heater. This type of action/education is often being conducted by local gas utilities or service companies and is not mandated by any local laws. Moreover, it was noted that in some areas, stands to elevate water heaters are available at retail stores where water heaters are sold. It was commented that the new water heater warning label is starting to affect consumer behavior with respect to storage and handling of flammable liquids. It was acknowledged that current data is not yet available to determine whether such a label has reduced injury accidents.

A working group member noted his personal experience with a contractor installing a replacement gas water heater at his residence. He commented that the contractor was not aware of the elevation of gas water heaters to address flammable vapor ignition. He pointed out that the water heater was being installed in his basement, and he did not obtain a opinion from the contractor specific to garage installation. The member also noted that the contractor had seen water heater stands in catalogs, but did not know what the stands are intended to address. He stated that he had the contractor elevate the replacement water heater in his basement by using masonry blocks. He commented that the water heater could not be elevated to a point where the combustion air inlet would be 18 inches off the floor, due to ceiling clearances. He also commented that the current venting system had to be shortened to accommodate the elevation of the water heater. It was pointed out that if a consumer has similar venting and ceiling problems and installs a water heater designed with a permanent 18-inch stand, the consumer may cut off a section of the stand to facilitate installation, lowering the water heater below the 18-inch requirement.

It was reported that Canada currently has no activity involving consideration to redesign water heaters to address the concern. It was noted that Canada presently has mandated appropriate warning labels/markings on all gasoline containers to address this hazard. It was agreed that the Canadian laws and standards associated with this subject would be obtained for working group review. Several working group members agreed that similar gas container labeling, "child-proof" gas container caps, coupled with better education on the handling of flammables, would address the issues involved with improper use, handling and storage of gasoline. A member directly involved with such accidents noted that many accidents could have been prevented if the gasoline container involved had employed a "child-proof" cap. It was noted that gasoline suppliers and the gasoline container industry should take a more active role in education and prevention of flammable vapor ignition accidents. It was commented that the gas containers presently in use in the U.S. do not employ labeling sufficient enough to address the concern. It was commented that the Uniform Fire Code may contain requirements for gasoline container