8

Feasibility Study of Obtaining Field Data on Cigarette-Ignited Fires

Technical
Study Group
Cigarette Safety
Act of 1984

October 1987

BEATRICE HARWOOD
LINDA FANSLER

U.S.
Consumer
Product
Safety
Commission

Mission and Members

The Technical Study Group on Cigarette and Little Cigar Fire Safety was established by Public Law 98-567, the Cigarette Safety Act of 1984, on October 30, 1984. Its mission is to:

"undertake such studies and other activities as it considers necessary and appropriate to determine the technical and commercial feasibility, economic impact, and other consequences of developing cigarettes and little cigars that will have a minimum propensity to ignite upholstered furniture or mattresses. Such activities include identification of the different physical characteristics of cigarettes and little cigars which have an impact on the ignition of upholstered furniture and mattresses, an analysis of the feasibility of altering any pertinent characteristics to reduce ignition propensity, and an analysis of the possible costs and benefits, both to the industry and the public, associated with any such product modification."

Copies of this or any other reports of the Technical Study Group may be obtained from Mr. Colin B. Church, Secretariat, Technical Study Group, Consumer Product Safety Commission, 5401 Westbard Avenue, Washington, D.C., 20207.

MEMBERS:
Richard G. Gann, Ph.D., Chairman
Edward Press, M.D., Vice-Chairman
Charles M. Carey
James L. Charles, Ph.D.
Joseph W. Cullen, Ph.D.
John C. Gerard
James F. Hoebel
Preston H. Leake, Ph.D.
Michael D. McGibeny
Andrew McGuire
Wendy H. Poel
Alan Rodgman, Ph.D.
Alexander W. Spears, III, Ph.D.
Henry Tovey
Judith P. Wilkenfeld, Esq.

PAST MEMBERS:
Howard Beales, III
Harry I. Cohen
Craig G. Drummond
Max Hausermann, Ph.D.

Feasibility Study of Obtaining Field Data on Cigarette-Ignited Fires

8

Technical
Study Group
Cigarette Safety
Act of 1984

October 1987

BEATRICE HARWOOD
LINDA FANSLER

U.S.
Consumer
Product
Safety
Commission

Executive Summary[1]

This report describes the results of a short-term pilot study designed to evaluate the feasibility of collecting field data about fires ignited by cigarettes. Results from the pilot study indicated that a full scale study is feasible.

Specifically, the pilot study sought to determine whether the following data could reasonably be collected about the universe of cigarette fires that occur within a sample population:

- the cigarette[2] that ignited the fire
- household materials first ignited by the cigarette
- demographic characteristics of the smoker

The ultimate purpose of obtaining this information would be to evaluate differences between the physical characteristics of cigarettes involved in fires and characteristics of marketed cigarettes. If a full-scale field study appeared practicable, recommendations about its scope and methodology were to be made.

A cooperative effort was planned between staff of the U.S. Consumer Product Safety Commission (CPSC) and the International Association of Fire Chiefs (IAFC). Nine fire departments agreed to participate, submitting a one-page supplemental report to their routine fire incident report. The data collection period was roughly March and April, 1987.

When possible, fire personnel collected samples of the cigarettes and of the materials first ignited. Collected furniture and bedding samples were examined by CPSC's Engineering Sciences Laboratory for fabric and fiber identification.

Based on 1984 fire experience, about 200 cigarette fires were expected during the reporting period. A total of 100 reports were received and 60 percent of these reports identified the characteristics of the cigarette involved. Response rates for demographic characteristics of the smoker varied: age, sex and race were generally well-reported, while other socio-economic factors such as education and income were not. With additional training it is expected that response rates from the pilot study could be significantly improved.

The primary cigarette characteristics of interest were tobacco density, paper porosity, cigarette circumference, tobacco column length, weight of tobacco, and filter/non-filter. From the data provided by cigarette manufacturers, these characteristics were identified for cigarettes involved in fires, and the distribution of these characteristics was compared with the sales-weighted characteristics of cigarettes sold in the U.S. during 1986.

Although detailed analysis of the data was outside the scope of the pilot study, it is pertinent to the rationale for a follow-up study that substantial differences were found between certain characteristics of cigarettes associated with the reported fires and the 1986 distribution of marketed cigarettes. Specifically, the percentage of unfiltered cigarettes involved in fires was 25 percent, compared with a 6 percent U.S. market share, and the mean amount of tobacco was 848 mg, compared with a mean value of 767 mg for cigarettes sold during 1986.

In terms of *sampling error* these differences were highly significant, even for a sample of 59 cases. Sampling error, however, does not address the question of whether the kinds of cigarettes smoked in the communities sampled or, more importantly, the kinds of cigarettes smoked by identifiable demographic subgroups who are at known high risk of having fires, differ substantially from the total U.S. experience.

In summary, results from the pilot study indicated that a full-scale study is both feasible and desirable. With additional training and lead time it is expected that response rates from the pilot study could be significantly improved.

In order to assure statistical validity, at least 500 fire incident reports should be collected in a full-scale field study. Study locations should be limited to 3 or 4 geographic areas, but complete coverage of all fire departments within the selected areas should be sought. A minimum of 6 months should be allocated for study design and field training, and 6 months for data collection.

Cigarette consumption data specific for the geographic areas selected for the field study should also be collected, probably by means of a consumer telephone survey.

---

[1] *This document is not an official report of the U.S. Consumer Product Safety Commission.*

[2] *A cigarette was defined by its brand, its length, whether menthol or non-menthol, whether filter or non-filter, and by its package type (whether hard pack or soft pack).*

Contents

List of Tables

Introduction

In January 1987 the Technical Study Group for the Cigarette Safety Act directed initiation of a pilot field study of residential fires ignited by cigarettes. The purpose of the study was to assess the feasibility of obtaining valid field data about: the kinds of cigarettes involved in fires; furniture and bedding materials that were ignited; and demographic and socio-economic characteristics of the smokers.

If the pilot study indicated that it was feasible to collect such data, then a large-scale data collection effort could be initiated. The ultimate aim of the large-scale study would be to determine whether epidemiological data corroborated laboratory test data about the effects of various physical characteristics of cigarettes on ignition propensity. (The primary critical physical characteristics identified in the lab were tobacco density, paper porosity, filter, and cigarette circumference). The data would also provide a baseline against which the effects of any remedial action could later be measured.

Methodology

In order to identify the relevant physical characteristics of cigarettes that start fires, it was necessary to obtain two sets of data:

- Fire incident data: the brand of cigarette involved in the fire, and other features identifiable in the field that uniquely characterized the particular cigarette "packing."[3]
- Manufacturers data: the relevant physical characteristics and 1986 sales of each cigarette "packing" manufactured.

Fire Incident Data

The collection of the fire incident data was accomplished jointly by the International Association of Fire Chiefs (IAFC) and the Directorate for Epidemiology, U.S. Consumer Product Safety Commission. Selection of participating fire departments was made by IAFC, from a computer-generated list of departments that submit incident data to the National Fire Incident Reporting System (NFIRS). (NFIRS data are collected by the U.S. Fire Administration.) The listing identified the number of residential cigarette-ignited fires attended by each NFIRS-reporting fire jurisdiction during 1984.

From this list IAFC selected nine fire departments to participate in the pilot study. Selection was based on several criteria, including: the number of cigarette fires reported in 1984, the geographic location of the fire department, and IAFC's judgment as to the department's capability to provide the needed data.

The nine participating fire departments were:

Baltimore, Maryland
Cleveland, Ohio
Columbus, Ohio
Fort Worth, Texas
Hartford, Connecticut
Jacksonville, Florida
Los Angeles, California
Rochester, New York
San Antonio, Texas

The designated project managers from each participating fire department met in Washington on February 11 to discuss the organization and logistics of the study, the data items to be collected, the data collection period, etc. The data collection period was set at March 1 through May 31, 1987.

In addition to identification of the type of cigarette that started the fire, information was sought about the household furnishings or materials that were first ignited and about the demographic characteristics of the smoker, including age, ethnic group, family income and educational attainment. Insofar as practical, the fire departments were asked to collect samples of the bedding or furniture that were ignited, as well as the cigarette package (or an unused cigarette from the package) identified as having caused the fire. A copy of the reporting form and instructions are attached at Appendix A. The nine fire departments each received $1,000 for their participation.

Based on 1984 fire reports, it was estimated that during a three-month period, about 400 residential cigarette fires would occur in the communities served by the nine participating fire jurisdictions.

For a variety of reasons, some fire departments were not able to initiate the study by March 1. As of May 18 it was estimated that probably a little less than two months of data had been received, on average. Thus, the estimated number of reports expected during a two-month period (or less, since some fire departments did not start on March 1) was about 250.

Manufacturers Data/Sales Data

Since characteristics such as paper porosity, tobacco density and circumference cannot be identified by field inspection, these data were obtained from cigarette manufacturers and

[3] *A cigarette packing is defined as a unique commercial cigarette described by its brand name, length, menthol or non-menthol, filter or non-filter, and package type (hard pack or soft pack).*

matched against the fire incident data described above.

Each of the six domestic manufacturers submitted a list of the unique packings currently being manufactured by their company, including the following characteristics for each:

tobacco column length (millimeters)
total cigarette length (millimeters)
circumference (millimeters)
paper porosity (Coresta units)
tobacco density (milligrams per cubic centimeter)
filter/non-filter
menthol/non-menthol
hard pack/soft pack

In order to compare the distribution of cigarettes sold with the distribution of cigarettes causing fires, it was necessary to weight the manufacturers' list of cigarette packings by their respective sales. (Because of time limitations no attempt was made to collect sales data specific for the metropolitan areas where the fire incident data were collected. A discussion of this option appears later.)

The January 31, 1987 edition of the Maxwell Report,[4] published by Furman Selz Mager Dietz and Birney, provides estimated 1986 cigarette sales by brand. The sales estimates were added to the cigarette packing data and the entire data set was computerized.

From these combined data it was possible to:

- determine the physical characteristics of cigarettes involved in fires, by matching the packings identified in fires with the packings listed by manufacturers.
- obtain tabulations of 1986 cigarette sales by physical characteristics.

Although the Maxwell Report did not provide sales data for some minor cigarette packings produced, and a few packings shown in the Maxwell Report did not appear on the lists provided by the manufacturers, about 99 percent of the estimated sales volume of 585 billion cigarettes sold were accounted for in the manufacturers data. A total of 247 unique packings were identified.

Calculation of tobacco mass per cigarette:

One hypothesis is that cigarette ignition resistance may be related to the total amount of fuel in a given cigarette. Therefore the mass of tobacco in each cigarette packing was computed from the data submitted by manufacturers, using the formula for the volume of a cylinder and the value for tobacco density:

Tobacco Mass = V × D, where

V = volume = $\pi r^2 h$
C = circumference
r = radius = $c/2\pi$
h = column length of tobacco
D = tobacco density (gms/cu cm)

Tobacco Mass = $\pi\ (c/2\pi)^2\ h \bullet D = c^2 hD/4\pi$

[4] *Although the publisher maintains that his data collection methods are confidential, he states that the data are not taken from a sample but purport to count all cigarettes sold.*

Results

Sales-Weighted Cigarette Data

A frequency distribution of all variables from the data submitted by manufacturers is shown in Table 1, weighted for sales volume as determined from the Maxwell Report. Table 2 shows mean values and standard errors for the parametric variables (tobacco density, paper porosity, circumference, column length and tobacco mass), both in the aggregate and specific for filter, length and menthol characteristics. Filtered cigarettes comprised 94.4 percent of the total and menthol cigarettes 28.3 percent. The largest variability was associated with paper porosity, and may reflect some problems with measuring this variable. Although 97 percent of the values (weighted by sales) fell between 10 and 51 Coresta[5] units, a few packings had values greater than 100, up to a maximum of 160 (Coresta unit). Cigarette circumference varied the least; more than 90 percent of cigarettes sold in 1986 were reported to be between 24 and 25 mm in circumference.

Sales data indicate that the physical characteristics of cigarettes are different for filtered than for non-filtered cigarettes, for menthol than for non-menthol cigarettes, and for 100 mm length, compared with regular/king size.

Fire Incident Data

Response Rates

The fire departments submitted 100 cigarette fire reports during the collection period of approximately two months. Allowing for a decline in cigarette fires since the 250 cigarette fires reported in these areas during 1984, it appears that about 50 percent reporting was achieved.

A frequency distribution of the information obtained about the 100 cigarette fire incidents collected at the date of this report is shown in Table 3. It includes information collected directly from the supplemental fire incident reports, and the cigarette characteristics (tobacco density, paper porosity, etc.) determined from matching with manufacturers' data.

Of the 100 cases reported, a positive identification of the cigarette packing was made in 59 incidents. There were additional incidents in which some but not all of the information necessary to identify a unique packing were reported.

The form of material first ignited by the cigarette was specified in all but one of the 100 reports. Among the demographic characteristics of the smokers, race/ethnic group was reported in 84 percent of the incidents, age in 73 percent, sex in 70 percent, and a general evaluation of socio-economic status (high, medium, low) in 67 percent of the incidents. Income, education and census tract data had lower response rates—28 percent, 32 percent, and 27 percent, respectively.

Four deaths and 17 injuries occurred in the 100 fire incidents reported. Evidence of drug or alcohol use was identified in 37 percent of the 78 incidents reporting such information.

Comparison of Sales Data and Fire Incident Data

Mean values for tobacco density, paper porosity, circumference, column length and tobacco mass can be computed for the cigarettes reported in the fire incident reports. For illustration, these values are shown in Table 5, both in the aggregate and for specific smoker and cigarette characteristics. Smoker characteristics include age, race/ethnic group and sex. Cigarette characteristics include filter, menthol and length (regular/king, 100 mm).

As an example of what a formal study could provide, Table 6 shows a comparison of fire incident data and sales data based on the results of this feasibility study. The mean values for relevant physical characteristics (tobacco density, paper porosity, circumference, column length and tobacco mass) are shown, both in total and specific for filter, menthol and overall length. For the fire incident data, the range of values within two standard errors of the mean is also indicated. Statistically, if this were a random sample, one could say with 95 percent level of confidence, that the true mean lies within 2 standard errors of the sample mean.

A full analysis of the differences shown is outside the scope of this study, but in general the cigarettes involved in the fire incidents had a significantly higher mean density, lower mean paper porosity, larger mean circumference,

[5] *A Coresta unit is a measure of air flow through a given area of paper at a given pressure. The technical notation is cc/minute-cm². The higher the Coresta value, the more permeable the paper. Laboratory tests indicate that cigarette ignition propensity varies directly with paper permeability.*

Table 1. 1986 Cigarette Sales In Billions, by Cigarette Characteristics

LENGTH	FREQUENCY	PERCENT
REG/KING	348.5	60.5
100MM	212.58	36.9
XLONG	14.76	2.6

FILTER	FREQUENCY	PERCENT
FILTER	543.86	94.4
NONFIL	31.98	5.6

MENTHOL	FREQUENCY	PERCENT
NONMEN	412.64	71.7
MENTHOL	163.2	28.3

PACK	FREQUENCY	PERCENT
SOFT	479.39	83.3
HARD	96.45	16.7

TOBACCO DENSITY	FREQUENCY	PERCENT
174-204	14.64	2.5
205-214	7.1	1.2
215-224	39.02	6.8
225-234	23.5	4.1
235-244	298.11	51.8
245-254	113.27	19.7
255-264	50.04	8.7
265-274	16.55	2.9
275-284	13.6	2.4
297	0.01	0.0

CIGARETTE COL_LEN	FREQUENCY	PERCENT
45	0.01	0.0
53	0.4	0.1
55	2.64	0.5
57	47.33	8.2
58	52.32	9.1
59	31.52	5.5
60	10.95	1.9
61	39.72	6.9
63	94.52	16.4
64	35.28	6.1
65	2.47	0.4
67	6.19	1.1
68	97.14	16.9
69	14.37	2.5
70	12.67	2.2
72	83.44	14.5
73	12.53	2.2
84	15.42	2.7
85	8.6	1.5
90	8.32	1.4

Table 1. (Continued)

CIGARETTE TOT_LEN	FREQUENCY	PERCENT
69	3.35	0.6
70	10.42	1.8
80	48.81	8.5
83	4.6	0.8
84	81.48	14.1
85	199.84	34.7
98	0.24	0.0
99	49.01	8.5
100	163.33	28.4
120	14.76	2.6

CIRCUMF	FREQUENCY	PERCENT
21	9.81	1.7
21.8	0.55	0.1
22.23	0.01	0.0
22.29	0.11	0.0
22.3	1.09	0.2
22.32	0.24	0.0
22.33	0.32	0.1
22.34	1.32	0.2
22.5	0.5	0.1
22.6	0.24	0.0
23	0.01	0.0
23.01	0.35	0.1
23.02	0.01	0.0
23.1	9.91	1.7
23.2	7.03	1.2
24.05	7.21	1.3
24.1	6.27	1.1
24.2	0.26	0.0
24.27	1.25	0.2
24.4	0.14	0.0
24.46	3.59	0.6
24.47	1.94	0.3
24.48	0.25	0.0
24.52	3.42	0.6
24.56	0.15	0.0
24.6	30.18	5.2
24.7	19.87	3.5
24.75	46.89	8.1
24.8	48.67	8.5
24.84	2.18	0.4
24.85	159.32	27.7
24.86	14.84	2.6
24.87	0.38	0.1
24.9	102.69	17.8
24.91	2.33	0.4
24.92	0.79	0.1
24.93	0.68	0.1
24.96	0.34	0.1
24.97	4	0.7
25	83.81	14.6
25.02	0.2	0.0
25.03	0.01	0.0
25.07	2.46	0.4
25.1	0.2	0.0
25.3	0.01	0.0
25.4	0.01	0.0

PAPER POROSITY	FREQUENCY	PERCENT
<20	33.45	5.8
20-29	214.9	37.3
30-39	152	26.4
40-49	155.81	27.1
50-160	19.68	3.4

longer mean column length and greater mean tobacco mass than the respective mean values for cigarettes sold. (The fire incident value for mean paper porosity is contrary to what might be expected based on experimental laboratory tests. Other mean values are in the same direction.)

It should also be noted that unfiltered cigarettes appeared in this preliminary fire incident data far more frequently than expected. Although less than 6 percent of 1986 sales were unfiltered cigarettes, about 25 percent of the fire incidents reported started from unfiltered cigarettes. Table 7 includes additional tabulations of the fire incident data, by cigarette and smoker characteristics.

Furniture and Bedding Samples

Laboratory tests have shown that the ignition propensity of cigarettes is dependent on the kinds of fabrics and filling materials on which they are dropped. For this reason participating fire departments, when possible, collected samples of the furniture or bedding materials ignited. These samples were submitted to the CPSC Engineering Sciences Laboratory for fabric and filling identification. Seventy-three samples were analyzed; forty-six mattress samples and twenty-seven upholstered furniture samples. In some cases, the probable reasons for materials contributing to the ignition could be determined.

1. None of the cotton batting analyzed contained a smolder resistant treatment to prevent cigarette ignition.
2. Some samples contained materials in combinations that are known from laboratory tests to ignite easily.
3. The majority of the mattress samples were made using pre-standard construction techniques and/or materials.

Analysis of those collected samples also indicate that the reported age of a sample is often an unreliable indicator of materials or construction of a product. This was especially true of the mattress samples.

The complete results of this analysis are shown in Appendix B.

Table 2. Mean Density, Column Length, Circumference, Porosity and Tobacco Mass of Cigarettes Sold In 1986

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
DENSITY (MG/CC)	247	241.4	22.4	174.0	297.0	1.4
COL_LEN (MM)	247	65.7	10.8	45.0	90.0	0.7
CIRCUMF (MM)	247	24.7	1.0	21.0	25.4	0.1
POROSITY (CORESTA)	247	36.5	29.8	10.0	160.0	1.9
TOBACCO MASS (MG)	247	767.5	132.8	487.4	1139.0	8.4

Table 2A. Mean Density, Column Length, Circumference, Porosity and Tobacco Mass of Cigarettes Sold In 1986, by Filter

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
----------			FILTER			
DENSITY	231	241.1	22.9	174.0	281.0	1.5
COL_LEN	231	65.0	9.8	45.0	90.0	0.6
CIRCUMF	231	24.7	1.0	21.0	25.1	0.1
POROSITY	231	36.9	30.6	10.0	160.0	2.0
TOBACCO MASS	231	757.1	113.2	487.4	963.3	7.4
----------			NONFIL			
DENSITY	16	246.6	10.5	221.0	297.0	2.6
COL_LEN	16	77.6	10.5	68.0	85.0	2.6
CIRCUMF	16	24.9	0.1	24.6	25.4	0.0
POROSITY	16	29.2	7.1	18.0	51.0	1.8
TOBACCO MASS	16	944.0	149.4	741.5	1139.0	37.3

Table 2B. Mean Density, Column Length, Circumference, Porosity and Tobacco Mass of Cigarettes Sold in 1986, by Menthol

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			NONMEN			
DENSITY	153	240.5	22.5	174.0	297.0	1.8
COL_LEN	153	65.7	12.0	45.0	90.0	1.0
CIRCUMF	153	24.7	0.9	21.0	25.4	0.1
POROSITY	153	37.3	33.3	10.0	160.0	2.7
TOBACCO MASS	153	768.4	148.4	487.4	1139.0	12.0
			MENTHOL			
DENSITY	94	243.8	22.0	175.0	277.0	2.3
COL_LEN	94	65.5	8.6	55.0	90.0	0.9
CIRCUMF	94	24.6	1.0	21.0	25.1	0.1
POROSITY	94	34.6	23.0	10.0	160.0	2.4
TOBACCO MASS	94	765.3	103.1	490.2	960.4	10.6

Table 2C. Mean Tobacco Density, Column Length, Circumference, Paper Porosity and Tobacco Mass of Cigarettes Sold in 1986, by Length

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			REG/KING			
DENSITY	114	243.1	21.7	174.0	297.0	2.0
COL_LEN	114	62.1	10.4	45.0	85.0	1.0
CIRCUMF	114	24.9	0.2	24.0	25.4	0.0
POROSITY	114	34.4	35.2	18.0	150.0	3.3
TOBACCO MASS	114	743.6	153.9	487.4	1139.0	14.4
			100MM			
DENSITY	119	238.0	22.7	179.0	277.0	2.1
COL_LEN	119	69.9	2.8	67.0	73.0	0.3
CIRCUMF	119	24.6	0.8	21.0	25.0	0.1
POROSITY	119	40.6	24.4	19.0	160.0	2.2
TOBACCO MASS	119	802.8	95.4	598.1	960.4	8.7
			XLONG			
DENSITY	14	250.6	19.1	207.0	270.0	5.1
COL_LEN	14	87.8	2.6	85.0	90.0	0.7
CIRCUMF	14	21.7	0.9	21.0	23.1	0.2
POROSITY	14	26.2	12.4	10.0	44.0	3.3
TOBACCO MASS	14	824.3	74.7	732.6	963.3	20.0

Table 3. Cigarette Fire Incidents Reported by Nine Fire Departments, by Cigarette Characteristics, Material Ignited, and Smoker Characteristics

LENGTH	FREQUENCY	PERCENT
UNKNOWN	31	
REG/KING	48	69.6
100MM	20	29.0
XLONG	1	1.4

FILTER	FREQUENCY	PERCENT
UNKNOWN	28	
FILTER	53	73.6
NONFIL	19	26.4

MENTHOL	FREQUENCY	PERCENT
UNKNOWN	33	
NONMEN	44	65.7
MENTHOL	23	34.3

PACK	FREQUENCY	PERCENT
UNKNOWN	36	
SOFT	60	93.8
HARD	4	6.3

TOBACCO DENSITY	FREQUENCY	PERCENT
UNKNOWN	41	
231	1	1.7
234	1	1.7
235	1	1.7
239	8	13.6
240	8	13.6
241	2	3.4
242	5	8.5
243	8	13.6
245	4	6.8
247	1	1.7
248	2	3.4
252	12	20.3
255	3	5.1
260	1	1.7
267	1	1.7
276	1	1.7

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 3. (Continued)

CIGARETTE COL_LEN	FREQUENCY	PERCENT
UNKNOWN	41	
57	2	3.4
58	1	1.7
59	1	1.7
61	3	5.1
63	14	23.7
64	4	6.8
68	3	5.1
70	3	5.1
72	11	18.6
73	3	5.1
84	13	22.0
85	1	1.7

CIGARETTE TOT_LEN	FREQUENCY	PERCENT
UNKNOWN	41	
70	3	5.1
80	3	5.1
84	23	39.0
85	13	22.0
99	6	10.2
100	11	18.6

CIRCUMF	FREQUENCY	PERCENT
UNKNOWN	41	
24.52	2	3.4
24.6	2	3.4
24.7	3	5.1
24.75	8	13.6
24.8	10	16.9
24.84	1	1.7
24.85	8	13.6
24.86	12	20.3
24.9	9	15.3
25	4	6.8

PAPER POROSITY	FREQUENCY	PERCENT
UNKNOWN	41	
19	7	11.9
25	6	10.2
29	10	16.9
30	5	8.5
31	13	22.0
32	2	3.4
36	2	3.4
38	1	1.7
40	2	3.4
43	2	3.4
44	1	1.7
45	4	6.8
47	4	6.8

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 3. (Continued)

INCOME	FREQUENCY	PERCENT
UNKNOWN	72	72.0
1-9999	7	7.0
10000-19999	9	9.0
20000-29999	7	7.0
30000+	5	5.0

SOCIOECO	FREQUENCY	PERCENT
UNKNOWN	33	
LOW	43	64.2
MIDDLE	22	32.8
UPPER	2	3.0

EDUCATION	FREQUENCY	PERCENT
UNKNOWN	68	
06YRS	1	3.1
08YRS	4	12.5
09YRS	2	6.3
10YRS	4	12.5
11YRS	1	3.1
12YRS	19	59.4
16YRS	1	3.1

DRUGS	FREQUENCY	PERCENT
UNKNOWN	22	
NO	49	62.8
YES	29	37.2

FLAME DAMAGE	FREQUENCY	PERCENT
UNKNOWN	15	
OBJECT OF ORIGIN	30	35.3
PART OF ROOM	16	18.8
ROOM	23	27.1
FLOOR	9	10.6
STRUCTURE	5	5.9
BEYOND	2	2.4

INJURIES	FREQUENCY	PERCENT
UNKNOWN	17	
0	72	86.7
1	6	7.2
2	4	4.8
3	1	1.2

DEATHS	FREQUENCY	PERCENT
UNKNOWN	17	
0	80	96.4
1	2	2.4
2	1	1.2

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 3. (Continued)

FIREDEPT	FREQUENCY	PERCENT
LOSANGEL	29	29.0
ROCHESTR	5	5.0
CLEVELND	14	14.0
SANANTON	2	2.0
FORTWRTH	7	7.0
BALTIMRE	19	19.0
COLUMBUS	11	11.0
HARTFORD	2	2.0
JACKSONV	11	11.0

MATERIAL IGNITED	FREQUENCY	PERCENT
UNKNOWN	1	
CHAIR	13	13.1
SOFA	22	22.2
MATTRESS	40	40.4
OTHER BEDDING	8	8.1
OTHER	16	16.2

AGE OF MATERIAL	FREQUENCY	PERCENT
UNKNOWN	50	
1YR	4	8.0
2YRS	2	4.0
3YRS	3	6.0
5YRS	11	22.0
6YRS	1	2.0
7YRS	3	6.0
9YRS	2	4.0
10YRS	14	28.0
15YRS	3	6.0
20YRS	5	10.0
44YRS	1	2.0
57YRS	1	2.0

AGE OF SMOKER	FREQUENCY	PERCENT
UNKNOWN	27	27.0
15-24YRS	13	13.0
25-44YRS	22	22.0
45-64YRS	27	27.0
65+YRS	11	11.0

SEX	FREQUENCY	PERCENT
UNKNOWN	30	
FEMALE	29	41.4
MALE	41	58.6

RACE	FREQUENCY	PERCENT
UNKNOWN	16	
BLACK	33	39.3
OTHER	11	13.1
CAUCASN	40	47.6

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 4. Cigarette Fire Incidents Reported by Nine Fire Departments, by Form of Material First Ignited and Age of Material

AGE OF MATERIAL	MATERIAL					
FREQUENCY	UNKNOWN	UPH FURN	MATTRESS	BEDDING	OTHER	TOTAL
UNKNOWN	1	14	20	4	11	50
LT 5YRS	0	4	1	0	4	9
5-9YRS	0	6	7	3	1	17
10-14YRS	0	7	7	0	0	14
15-19YRS	0	0	3	0	0	3
20+YRS	0	4	2	1	0	7
TOTAL	1	35	40	8	16	100

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 5. Mean Tobacco Density, Column Length, Circumference, Paper Porosity and Tobacco Mass of Cigarettes Involved in Fires

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
DENSITY (MG/CC)	59	245.5	7.9	231.0	276.0	1.0
COL_LEN (MM.	59	70.4	8.8	57.0	85.0	1.1
CIRCUMF (MM)	59	24.8	0.1	24.5	25.0	0.0
POROSITY (CORESTA)	59	31.8	8.0	19.0	47.0	1.0
TOBACCO MASS (MG)	59	848.2	118.0	686.3	1041.0	15.4

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 5A. Mean Tobacco Density, Column Length, Circumference, paper Porosity and Tobacco Mass of Cigarettes Involved in Fires, by Filter

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
FILTER						
DENSITY	42	244.3	8.2	234.0	276.0	1.3
COL_LEN	42	65.9	5.1	57.0	73.0	0.8
CIRCUMF	42	24.8	0.1	24.5	25.0	0.0
POROSITY	42	31.5	9.0	19.0	47.0	1.4
TOBACCO MASS	42	788.1	62.8	686.3	908.8	9.7
NONFIL						
DENSITY	17	248.5	6.2	231.0	252.0	1.5
COL_LEN	17	81.6	5.5	70.0	85.0	1.3
CIRCUMF	17	24.8	0.1	24.6	24.9	0.0
POROSITY	17	32.8	5.0	29.0	47.0	1.2
TOBACCO MASS	17	996.8	86.1	797.8	1041.0	20.9

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

193-807 0 - 87 - 2 : QL 3

Table 5B. Mean Tobacco Density, Column Length, Circumference, Paper Porosity and Tobacco Mass of Cigarettes Involved in Fires, by Menthol

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			NONMEN			
DENSITY	40	246.3	6.5	231.0	260.0	1.0
COL_LEN	40	72.4	9.7	57.0	85.0	1.5
CIRCUMF	40	24.8	0.1	24.5	25.0	0.0
POROSITY	40	33.7	6.4	25.0	47.0	1.0
TOBACCO MASS	40	876.5	128.3	686.3	1041.0	20.3
			MENTHOL			
DENSITY	19	243.6	10.1	239.0	276.0	2.3
COL_LEN	19	66.3	4.3	61.0	72.0	1.0
CIRCUMF	19	24.8	0.0	24.7	24.8	0.0
POROSITY	19	27.8	9.7	19.0	45.0	2.2
TOBACCO MASS	19	788.6	60.7	713.5	892.2	13.9

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 5C. Mean Tobacco Density, Column Length, Circumference, Paper Porosity and Tobacco Mass of Cigarettes Involved in Fires, by Length

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			REG/KING			
DENSITY	42	245.9	7.8	231.0	276.0	1.2
COL_LEN	42	70.0	10.4	57.0	85.0	1.6
CIRCUMF	42	24.8	0.1	24.6	25.0	0.0
POROSITY	42	29.4	6.0	19.0	47.0	0.9
TOBACCO MASS	42	846.6	139.4	686.3	1041.0	21.5
			100MM			
DENSITY	17	244.4	8.2	234.0	267.0	2.0
COL_LEN	17	71.5	1.7	68.0	73.0	0.4
CIRCUMF	17	24.8	0.1	24.5	25.0	0.0
POROSITY	17	37.9	9.4	19.0	47.0	2.3
TOBACCO MASS	17	852.3	25.1	808.7	908.8	6.1
			XLONG			
DENSITY	0	.	.	.	.	.
COL_LEN	0	.	.	.	.	.
CIRCUMF	0	.	.	.	.	.
POROSITY	0	.	.	.	.	.
TOBACCO MASS	0	.	.	.	.	.

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 5D. Mean Tobacco Density, Column Length, Circumference, Paper Porosity and Tobacco Mass of Cigarettes Involved in Fires, by Race

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			BLACK			
DENSITY	23	245.0	7.8	231.0	267.0	1.6
COL_LEN	23	72.1	8.2	63.0	85.0	1.7
CIRCUMF	23	24.8	0.1	24.5	24.9	0.0
POROSITY	23	31.4	9.5	19.0	47.0	2.0
TOBACCO MASS	23	866.2	113.5	736.9	1041.0	23.7
			OTHER			
DENSITY	6	245.0	5.8	239.0	252.0	2.4
COL_LEN	6	71.3	10.5	61.0	84.0	4.3
CIRCUMF	6	24.8	0.1	24.8	24.9	0.0
POROSITY	6	29.3	7.0	19.0	40.0	2.9
TOBACCO MASS	6	860.0	149.2	713.5	1041.0	60.9
			CAUCASN			
DENSITY	30	245.9	8.4	234.0	276.0	1.5
COL_LEN	30	68.9	9.0	57.0	84.0	1.6
CIRCUMF	30	24.8	0.1	24.5	25.0	0.0
POROSITY	30	32.6	7.1	19.0	47.0	1.3
TOBACCO MASS	30	832.1	117.0	686.3	1041.0	21.4

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 5E. Mean Tobacco Density, Column Length, Circumference, Paper Porosity and Tobacco Mass of Cigarettes Involved in Fires, by Sex

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			FEMALE			
DENSITY	23	246.9	10.1	231.0	276.0	2.1
COL_LEN	23	70.6	8.9	57.0	85.0	1.8
CIRCUMF	23	24.8	0.1	24.6	24.9	0.0
POROSITY	23	32.7	8.5	19.0	47.0	1.8
TOBACCO MASS	23	853.5	111.4	686.3	1041.0	23.2
			MALE			
DENSITY	29	245.5	6.2	235.0	255.0	1.1
COL_LEN	29	70.8	9.7	58.0	84.0	1.8
CIRCUMF	29	24.8	0.1	24.5	25.0	0.0
POROSITY	29	30.7	8.1	19.0	47.0	1.5
TOBACCO MASS	29	854.0	134.4	698.1	1041.0	24.9

Table 5F. Mean Tobacco Density, Column Length, Circumference, Paper Porosity and Tobacco Mass of Cigarettes Involved in Fires, by Age of Smoker

VARIABLE	N	MEAN	STANDARD DEVIATION	MINIMUM VALUE	MAXIMUM VALUE	STD ERROR OF MEAN
			UNKNOWN			
DENSITY	5	239.2	3.3	234.0	242.0	1.5
COL_LEN	5	64.8	4.2	61.0	72.0	1.9
CIRCUMF	5	24.9	0.1	24.8	25.0	0.0
POROSITY	5	29.6	5.3	25.0	38.0	2.4
TOBACCO MASS	5	763.3	46.8	713.5	837.9	20.9
			15-24YRS			
DENSITY	9	240.7	1.9	239.0	245.0	0.6
COL_LEN	9	65.2	5.3	58.0	72.0	1.8
CIRCUMF	9	24.8	0.1	24.7	25.0	0.0
POROSITY	9	27.2	9.8	19.0	45.0	3.3
TOBACCO MASS	9	768.7	60.5	698.1	863.4	20.2
			25-44YRS			
DENSITY	15	243.8	4.2	239.0	252.0	1.1
COL_LEN	15	69.1	9.3	57.0	84.0	2.4
CIRCUMF	15	24.8	0.1	24.5	25.0	0.0
POROSITY	15	32.5	9.3	19.0	47.0	2.4
TOBACCO MASS	15	824.9	118.5	686.3	1041.0	30.6
			45-64YRS			
DENSITY	21	247.8	7.5	231.0	260.0	1.6
COL_LEN	21	74.1	9.5	59.0	85.0	2.1
CIRCUMF	21	24.8	0.0	24.7	24.9	0.0
POROSITY	21	33.3	6.3	25.0	47.0	1.4
TOBACCO MASS	21	903.5	126.2	687.4	1041.0	27.5
			65+YRS			
DENSITY	9	251.1	12.7	239.0	276.0	4.2
COL_LEN	9	72.1	7.7	63.0	84.0	2.6
CIRCUMF	9	24.8	0.1	24.5	24.9	0.0
POROSITY	9	33.2	8.6	19.0	47.0	2.9
TOBACCO MASS	9	884.8	98.5	737.0	1041.0	32.8

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 6. Comparison of Means: Sales Data and Preliminary Fire Incident Data, by Cigarette Characteristics

Cigarette Characteristics	Sample Size	Mean Value: Tobacco Density (mg/cc)	Paper Porosity (Coresta)	Circum-ference (mm)	Column Length (mm)	Tobacco Mass (mg)
All Sales	576 bill.	241.4	36.5	24.69	65.7	767.5
All Fires	59	245.5	31.8	24.82	70.4	848.2
95% Conf. Interval		±2.0	±2.1	±0.03	±2.3	±30.7
Non-Filtered						
Sales	32 bill.	246.6	29.2	24.88	77.6	944.0
Fires	17	248.5	32.8	24.84	81.6	996.8
95% Conf. Interval		±3.0	±2.4	±0.03	±2.7	±41.8
Filtered						
Sales	544 bill.	241.1	36.9	24.68	65.0	757.1
Fires	42	244.3	31.5	24.81	65.9	788.1
95% Conf. Interval		±2.5	±2.8	±0.03	±1.6	±19.4
Menthol						
Sales	163 bill.	243.8	34.6	24.58	65.5	765.3
Fires	19	243.6	27.8	24.78	66.3	788.6
95% Conf. Interval	±4.6	±4.5	±0.02	±2.0	±27.8	
Non-Menthol						
Sales	413 bill.	240.5	37.3	24.74	65.7	768.4
Fires	40	246.4	33.7	24.84	72.4	876.5
95% Conf. Interval		±2.1	±2.0	±0.04	±3.1	±40.6
Reg./King Size						
Sales	348 bill.	243.1	34.4	24.86	62.1	743.6
Fires	42	245.9	29.4	24.84	70.0	846.6
95% Conf. Interval		±2.4	±1.8	±0.02	±3.2	±43.0
100 mm						
Sales	213 bill.	238.0	40.6	24.62	69.9	802.8
Fires	17	244.4	37.9	24.77	71.5	852.3
95% Conf. Interval		±4.0	±	4.6±0.06	±0.8	±12.2
120 mm						
Sales	15 bill.	250.6	26.2	21.71	87.8	824.3
Fires	–	–	–	–	–	–
95% Conf. Interval	–	–	–	–	–	–

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur.

SOURCE: Fire Incident Data from Nine Fire Departments
Cigarette Characteristics Data from Six Manufacturers
Sales Data from Maxwell Report, Jan. 1987
U.S. Consumer Product Safety Commission/EPHA

Table 7. Cigarette Fire Incidents Reported by Nine Fire Departments, by Selected Demographic and Cigarette Characteristics

TABLE OF RACE BY FILTER

RACE	FILTER			
FREQUENCY	UNKNOWN	FILTER	NONFIL	TOTAL
UNKNOWN	15	1	0	16
BLACK	6	19	8	33
OTHER	4	5	2	11
CAUCASN	3	28	9	40
TOTAL	28	53	19	100

TABLE OF SEX BY FILTER

SEX	FILTER			
FREQUENCY	UNKNOWN	FILTER	NONFIL	TOTAL
UNKNOWN	19	8	3	30
FEMALE	3	19	7	29
MALE	6	26	9	41
TOTAL	28	53	19	100

TABLE OF INCOME BY FILTER

INCOME	FILTER			
FREQUENCY	UNKNOWN	FILTER	NONFIL	TOTAL
UNKNOWN	25	35	12	72
1000-9999	0	5	2	7
10000-19999	2	5	2	9
20000-29999	0	4	3	7
30000+	1	4	0	5
TOTAL	28	53	19	100

TABLE OF AGE OF SMOKER BY FILTER

AGE OF SMOKER	FILTER			
FREQUENCY	UNKNOWN	FILTER	NONFIL	TOTAL
UNKNOWN	19	8	0	27
15-24YRS	2	11	0	13
25-44YRS	3	15	4	22
45-64YRS	3	13	11	27
65+YRS	1	6	4	11
TOTAL	28	53	19	100

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Table 7. (Continued)

TABLE OF INCOME BY MENTHOL

INCOME	MENTHOL			
FREQUENCY	UNKNOWN	NONMEN	MENTHOL	TOTAL
UNKNOWN	27	29	16	72
1000-9999	0	6	1	7
10000-19999	4	3	2	9
20000-29999	0	5	2	7
30000+	2	1	2	5
TOTAL	33	44	23	100

TABLE OF RACE BY MENTHOL

RACE	MENTHOL			
FREQUENCY	UNKNOWN	NONMEN	MENTHOL	TOTAL
UNKNOWN	16	0	0	16
BLACK	6	13	14	33
OTHER	5	3	3	11
CAUCASN	6	28	6	40
TOTAL	33	44	23	100

TABLE OF SEX BY MENTHOL

SEX	MENTHOL			
FREQUENCY	UNKNOWN	NONMEN	MENTHOL	TOTAL
UNKNOWN	21	5	4	30
FEMALE	4	17	8	29
MALE	8	22	11	41
TOTAL	33	44	23	100

These data are intended to demonstrate the data that can be obtained from a comprehensive study. They may not be representative of all cigarette fires that occur nationally.

Discussion

As of May 18, 1987, data collection for the fire incident part of the feasibility study was still in progress. Nevertheless, it is unlikely that additional data would materially affect appraisal of the feasibility of an expanded study.

About half as many incidents were reported as expected, and among those reported, identification of the unique cigarette packing involved was achieved about 60 percent of the time. While these percentages were lower than desirable, they were higher than might have been anticipated, given resource constraints and the nature of the information sought. There is no intuitively apparent reason to believe that the cigarette fire incidents that were not reported, or for which cigarette brand was not identified, were different from the incidents with complete information.

Even if complete reporting had been achieved, the reports did not represent a random probability sample of all cigarette fires in the country. In general they were drawn from relatively large metropolitan fire departments. Suburban and rural communities were not well represented. Thus it is possible that local differences in cigarette sales may have affected the results.

This problem could be overcome if it were possible to obtain local sales data for the communities served by participating fire departments. However, there would still remain the problem of separating causal from associative relationships. That is, if one cigarette characteristic, such as high tobacco density, were associated with more fires than expected, based on sales, was this because of the characteristic of the cigarette or because of the characteristics of the smoker? Are certain kinds of smokers, such as older persons, more likely to smoke high (tobacco) density cigarettes and also more likely to have fires? If so, then both the risk of fire and the likelihood of smoking a high density cigarette would be related to age, and the relationship between density and risk of fire could be associative, not causal.

The ideal way to separate these effects would be to obtain demographic data about both local cigarette sales and fire incidents. With regard to fire incident data, it would be feasible to collect age, race, and sex data, based on the response rates achieved in the present study. The relatively low response rates for education and income could probably be improved with more time and resources. Identification of census tract information might also be accomplished with adequate planning time, so that demographic characteristics of the census tracts where fires took place could be compared with demographic characteristics of the entire community.

With regard to sales data, it is doubtful that individual cigarette manufacturers would share proprietary information. Even if they would, it is uncertain whether the data would be specific for the communities in which fire incident information might be sought.

Probably the most practical way to obtain community-specific sales and demographic data about smokers would be to conduct consumer or retail outlet surveys in areas where fire incident data were collected. Although brand preferences may vary by community, this would not affect comparisons within that community.

If the purpose of a field study is more narrowly defined; that is, if it seeks only to establish a baseline against which the effects of alterations in cigarette characteristics can later be measured, then it would not be necessary to obtain demographic information. The underlying assumption in this case would be that the demographic factors at work during the baseline study would remain essentially the same three or four years later, when the study was repeated in those same areas.

If an expanded study were undertaken along the same lines as the feasibility study, several methods of analysis are suggested. The data appear to lend themselves to a regression analysis, in which the independent variables are cigarette and smoker characteristics and the dependent variable is the occurrence of fire. The analysis would identify the cigarette and smoker characteristics that most affect the risk of fire, while holding all other factors constant.

Another method would be to compute relative risk for a variable of interest, such as tobacco density, while controlling for other variables that might also affect risk. For example, one might compare the percent of fires with the percent of cigarettes sold for cigarettes of varying density, adjusting for various age or socio economic groups, and/or for filtered and unfiltered cigarettes. This would be similar to the way mortality rates are adjusted for age, so that comparisons can be made between two groups of different age distribution, to eliminate the effect of the age differences.

In an expanded study it might be wise to consider limiting the number of participating communities to 3 or 4, but

expanding the coverage in those communities to include adjoining suburban or rural fire departments. Thus, only 3 or 4 local market surveys would be needed, and fire department coverage would more closely represent the national distribution.

In a full-blown study, at least six months should be allocated to orient participating fire departments and solve local logistical problems. Fire department personnel should participate actively in the study design. The importance of collecting socio-economic data should be fully explained, and local training should be conducted at each of the fire departments.

Based on the preliminary results shown here, the goal should be to collect about 500 cigarette fire reports. The absolute number is less important than ensuring that these cases are a reasonable representation of all such cases that occur in the communities sampled.

Decreasing sampling error (by increasing sample size) would be less important than avoiding systematic error. For example, the sampling errors associated with a proportion of 25 percent observed within random samples of various sizes are shown below:

Sample Size	Standard Error	95 % Confid. Interval
10	0.14	0.25 ± 0.28
59	0.06	0.25 ± 0.12
500	0.02	0.25 ± 0.04

Thus, although the standard error of the proportion decreases as the size of the sample increases, a random sample of 59 cases would be sufficient to show a significant difference between the proportion of unfiltered cigarettes observed in the fire incidents (25% ± 12%) and the proportion sold in the U.S. during 1986 (6%). However, sampling error does not address the problem of the representativeness of the sample or the causal nature of the association.

The level of reporting might be increased if the collection of furniture and bedding samples is not required. It is possible that some fire department companies did not complete the supplemental cigarette fire incident report because of the requirement to collect and process furniture or bedding samples.

Toward the end of the reporting period, participating fire departments were asked to comment on the study methodology and to recommend improvements. In general they recommended a longer and more comprehensive training period for fire department personnel. Some fire departments were reluctant to obtain socio-economic information from the smoker. Several fire departments questioned the accuracy of the expected number of fires during the reporting period, which were based on 1984 NFIRS data submitted by the fire departments themselves, through their respective states.

Conclusion

Based on data from the pilot study, an expanded study is both feasible and desirable. It is expected that the cigarette packing can be identified in at least 60 percent of the field reports. With adequate time to coordinate the study and solve logistical problems, it is reasonable to expect a comparable response rate for smoker socio-economic characteristics. Community smoking habits can be obtained from local surveys, so that appropriate measures of relative risk can be derived.

While no substantive conclusions can be drawn from the data actually collected for the feasibility study, the results are pertinent to the rationale for a more closely controlled study. If no differences were found between cigarettes sold in the U.S. and cigarettes involved in fires in the nine selected communities, it would be difficult to justify a further study. The fact that substantial differences were observed in certain areas suggests the need for an expanded effort.

193-807 0 - 87 - 3 : QL 3

Recommendations for Implementation of an Expanded Study

- Plan to collect 500 cigarette fire reports.
- Allow 6 months to enlist and train fire departments and 6 months to collect incident reports.
- Limit participation to 3 or 4 communities, but enlist the participation of all fire departments serving those communities.
- Collect market and demographic data about cigarettes smoked from a survey of consumers or retail outlets in the communities selected.

Acknowledgements

The authors acknowledge the cooperation of U.S. cigarette manufacturers in making available data on domestic cigarette characteristics used in this report.

Gary Briese, Executive Director of the International Association of Fire Chiefs (IAFC) provided the original impetus for the study, recommending it to the Technical Study Group. Colin Campbell and Jim Dalton, also of the International Association of Fire Chiefs, provided major assistance in its execution. The IAFC enlisted the support of nine fire departments, provided training, and supervised the fire data collection.

The following fire department representatives trained the local participants.

Bureau Chief Frank Little
Captain Kenneth Morris
Baltimore City Fire Dept. (MD)

Battalion Chief Michael Hovan
Cleveland Fire Dept. (OH)

Captain Mark DeVine
Fire Investigation
Columbus Fire Dept. (OH)

Dale Thomson
Director of Systems
Los Angeles City Fire Dept. (CA)

Deputy Chief James D. Miller
San Antonio Fire Department (TX)

Captain Eugene Hibbard
Rochester Fire Dept. (NY)

Captain H.S. Hinckley
Jacksonville Fire Dept. (FL)

Deputy Chief Donald Peacock
Fort Worth Fire Dept. (TX)

Inspector Walter McKenney
Hartford Fire Dept. (CT)

Appendix A

Supplemental Report Form for Residential Fires Started by Cigarettes

SUPPLEMENTAL REPORT
RESIDENTIAL FIRES STARTED BY CIGARETTES

°COMPLETE THIS FORM FOR ALL FIRES WHERE FIXED PROPERTY USE IS RESIDENTIAL (4), TYPE OF SITUATION IS STRUCTURAL FIRE (11) AND FORM OF HEAT IS SMOKING MATERIALS (3).

°SEE ADDITIONAL INSTRUCTIONS ON BACK.

I. Identifying Information

Date of Fire _____ Fire Dept. _____ Inc. No._____
Completed by _____ Company _____

II. Information about the Cigarette that Caused the Fire:

Brand _____
Check One:
Length: _____Regular or King (70-85mm); _____Long or Deluxe (100mm);
_____Extra long (110-120 mm)
Filter: _____Filtered; _____Unfiltered
Pack: _____Soft Pack; _____Hard Pack
Menthol: _____Menthol; _____Non-menthol

NOTE: If the remaining portion of the package of cigarettes that was involved can be retrieved, please collect the package, or one cigarette from the package. HOWEVER, COMPLETE THIS FORM EVEN IF YOU CANNOT IDENTIFY THE BRAND OF CIGARETTE OR COLLECT A SAMPLE CIGARETTE.

Did you collect a sample? ___Yes; ___No

III. Information about the Material First Ignited: (Check One)

____Chair; ____Sofa; ____Mattress; ____Other Bedding;
___Other: Please Specify_____

Approximate age of item specified above; in years:_____

Location of ignition (crevice, arm, edge of mattress, etc):_____

NOTE: If a mattress or upholstered furniture was ignited try to obtain a sample. (See instructions on back.) HOWEVER, COMPLETE THIS FORM EVEN IF YOU CANNOT COLLECT A SAMPLE. Did you collect a sample? ___Yes; ___No

IV. Information about the Smoker.

Age: _____ Sex: ____Male; ____Female
Race: ____White; ____Black; ____Other (Includes Hispanic)
Annual Family Income:_____
Approximate Socioeconomic Class: ____Low;____Middle;____Upper (Observation Only)
Education: Last Grade Completed: _____
Does it appear that smoker had been using drugs or alcohol prior to the fire?
_____Yes; _____No (observation only)

V. Short Narrative Describing Fire _____

_____

_____

_____

General Instructions

1. If possible, collect the information requested on this form at the scene of the fire. If not, try to obtain it later by telephone.

2. Submit the form even if you are not able to obtain the information requested.

3. Attach a copy of your NFIRS Incident Report Form to this supplemental report. (Be sure to include census tract information on the Incident Report Form.)

4. Mail at least weekly to:

   Colin Campbell
   International Association of Fire Chiefs
   1329 18th Street N.W.
   Washington, DC 20036 (202/833-3420)

5. If a cigarette, mattress or upholstered furniture sample was collected, follow the instructions below.

Instructions for Sample Collection

1. Collect a sample of the mattress or upholstered furniture ONLY, not of other materials. (Even if bedding rather than the mattress ignited first, collect a sample of the mattress, not the bedding item.) The sample should be a maximum of 10 inches by 10 inches and no smaller than 3 inches by 3 inches.

2. Take the sample from the area of the furniture or mattress that appeared to have been first ignited. Include both burned and unburned portions in your sample, if possible.

3. Cigarette: Place cigarette or package sample in the envelope provided.

4. Mattress: Include the mattress surface material and all filling materials, excluding core-springs. Pack sample materials in order of construction, label accordingly, and place inside plastic bag that has been provided.

5. Upholstered Furniture: The sample should include the upholstery fabric, welt cord, if present, and all filling and padding materials in the area of ignition, excluding the frame. If a crevice ignition is suspected, include materials from the cushion as well as the inside back or arms. Pack sample materials in order of construction, label accordingly, and place inside plastic bag that has been provided.

6. Place all sample materials and a copy of this report form and the Incident Report Form in the franked mailing envelope that has been provided. It will not need postage.

Appendix B

Memorandum from Linda Fansler to Beatrice Harwood: Final Analysis of Materials Data, Pilot Study, Cigarette Safety Project

UNITED STATES GOVERNMENT

MEMORANDUM

U.S. CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON,D.C. 20207

29 JUL 1987

TO : Beatrice Harwood, EPHA
Through: James I. Price, Director, ESMT

FROM : Linda Fansler, ESMT

SUBJECT: Final Analysis of Materials Data, Pilot Study, Cigarette Safety Project

BACKGROUND

The Technical Study Group, under the Cigarette Safety Act of 1984, is conducting a program to determine the technical and commercial feasibility of manufacturing cigarettes that would have a minimal propensity for causing upholstered furniture and bedding fires. One component of this program is to obtain fire incident data to track whether improvements in fire losses will result from the Cigarette Safety Act program.

A pilot study was conducted to collect field data and samples from fires ignited by cigarettes. The objective of this pilot study was to determine the types and quality of data and samples obtainable. The information gained from the pilot study could be used to determine the feasibility of conducting a similar study on a larger scale. This future study could be used to track improvements in fire losses resulting from the Cigarette Safety Act program. The information collected for this pilot study was collected during a three month period, from March 1, 1987, through May 31, 1987.

A data collection report was developed for the pilot study and is attached. In addition to reporting the data requested on the form, two types of samples were to be collected. Samples of the kind of cigarettes that caused the fire and samples of the upholstered furniture or mattress involved in the fire were to be collected if possible.

The upholstered furniture and mattress samples were sent to the Engineering Laboratory for analysis. The analysis included, if possible, fiber and filling identification, fabric weight, foam density, and the presence/absence of borate (a smolder resistant treatment) on cotton batting. This materials identification was to serve two purposes. The first is to establish the kinds and types of soft furnishings involved in cigarette ignited fires before the implementation of any changes in the ignition propensity of cigarettes due to the Cigarette Safety Act program. The second is to establish the feasibility of collecting material samples in a program of this type. There was some early concern as to the amount and quality of material samples that would be collected.

This report will discuss the materials data collected as it establishes background for future studies, the quantity and quality of material samples collected, the results from the laboratory analysis[1], and suggestions for any future study.

DATA ANALYSIS

One hundred and thirty-eight data collection reports were received by Engineering Sciences indicating either upholstered furniture or a mattress was involved in a residential cigarette fire. Of these, 73 reports included material samples which were sent to the laboratory for analysis. Table 1 summarizes those reports where a sample was collected. These data reflect only the incidents reported through the feasibility study. They may not be representative of the actual universe of cigarette related fires.

Useful information in establishing background information includes reported age of the item ignited by the cigarette, substrates involved and, to some extent, location of the ignition. In many cases the data collection reports did not include the age of the item and the location of ignition (i.e., cushion, crevice, edge, etc.). Also in many cases complete substrates involved in the fire may not have been included as part of the sample. This made it difficult to provide a thorough overall characterization of the samples received. However, a few generalizations can be made. The table below summarizes the age of the samples collected.

REPORTED AGE OF SAMPLES

	mattress	upholstered furniture
1-9 years	15	8
10-14 years	5	5
15-20 years	7	3
age unknown	19	11
total collected	46	27

This data indicates that, where age is reported, the majority of mattresses involved in these cigarette ignited fires were mattresses that should be complying with the Mattress Flammability Standard. However in many cases, these reported ages cannot be confirmed from the laboratory analysis due to insufficient samples provided. Certain materials and combinations of materials used in mattresses, such as untreated cotton batting directly under cellulosic ticking fabric or the use of a thin layer (<1/2 inch) of polyurethane foam directly over untreated cotton batting, were commonly found in mattresses produced before the Mattress Flammability Standard became effective in 1973. These clues are useful in confirming the age of a mattress.

This data also indicates that, where the age of the upholstered furniture was reported, a few of the samples may have been Phase 2 UFAC furniture. Phase 2 of the Upholstered Furniture Action Council (UFAC) voluntary standard for upholstered furniture went into effect in July 1983. Furniture made to meet this voluntary standard contains materials that are more resistant to cigarette ignition.

---

1 Stafford, Gail - Memorandum to Linda Fansler, "Laboratory Analysis of Fire Incident Samples for the Cigarette Safety Project", July 1987.

For example, the presence of heat conducting welt cord is an indication of Phase 2 furniture. However, because samples were insufficient, the age of the upholstered furniture samples cannot be confirmed from the laboratory analysis.

The table below summarizes the reported location of ignition.

LOCATION OF IGNITION FOR DATA REPORTS WITH SAMPLES

	mattress		upholstered furniture
center	14	crevice	14
head area	11	cushion	7
edge	14	arm	1
bedding	3	edge	1
unknown	4	unknown	4
total	46	total	27

This data indicates that the flat surface of a mattress was the location first ignited. The number of ignitions is distributed between the center and edge locations with slightly fewer in the head area. For upholstered furniture the seating area location (crevice and cushion) was reported the majority of the time as the location first ignited. The seating area of upholstered furniture has been identified as the location where dropped cigarettes tend to land and therefore has a higher cigarette ignition probability.

The table below summarizes the types of materials identified through laboratory analysis.

TYPES OF MATERIALS IDENTIFIED

	mattress ticking	upholstery fabric
cellulosic	16	12
thermoplastic	2	12
blend	2	-
vinyl	1	3

TYPES OF MATERIALS IDENTIFIED

	mattress filling material	uph. furniture filling material
cotton batting	31	12
polyurethane foam	10	11
polybutadiene foam	3	-
polyester	-	6
kapok	-	1

Although it was requested, all layers of either the upholstered furniture or mattress involved in the fire were not always included as part of the sample. This makes it difficult to determine the probable reason for material failure which led to an ignition. However, some trends were identified. They include the following:

1. None of the cotton batting analyzed had borate present. A commonly used smolder resistant treatment for cotton batting is the application of a borax derivative (borate, boric acid). Cotton batting is very susceptible to smoldering cigarette ignition unless treated. (Table 2)

2. Seven mattress samples contained "quilted ticking", where the top fabric layer is attached to one or more layers underneath. In six of these mattresses, the layer found directly under the top fabric layer was a thin layer of polyetherurethane foam. Research has shown that in general a minimum of 1/2 inch thickness is necessary to prevent cigarette ignition. In these six cases, the foam layer was less than 1/2 inch. In the seventh case, the fabric layer was quilted to untreated cotton batting. In addition, five of the ticking fabrics were 100% cellulosic (the two remaining tickings were either 100% thermoplastic or a cellulosic/thermoplastic blend). These two factors may have contributed in these cases to the cigarette ignition. (Table 3)

3. Ten mattress samples contained both cellulosic ticking and untreated cotton batting. Although there is no mention of order, if it is assumed that the untreated cotton batting was found directly underneath the cellulosic ticking, this would have contributed to the cigarette ignition of these mattresses. (Table 4)

4. Two upholstered furniture samples contained shredded polyetherurethane foam. Research at CPSC has shown that shredded foam generally does not meet the UFAC filling/padding component test and can contribute to cigarette ignition. (Table 5)

5. Two upholstered furniture samples contained lightweight cellulosic upholstery fabric. Research at CPSC has shown that these lightweight fabrics have a moderate likelihood of ignition. (Table 6)

We attempted to determine whether those mattresses for which samples were obtained would be expected to ignite from a cigarette (i.e., comply with the Mattress Flammability Standard). Table 7) We based this determination on the analysis of the samples, knowledge of changes in materials used in order to meet the standard, and experience from tests relating to mattress flammability. Forty-three samples were complete enough for this analysis. These results, shown in Table 7, indicate that four of the mattress samples would not be expected to ignite from a cigarette based on the analysis of the samples provided. These samples were determined to be typical post-standard constructions. The expected performance could not be determined in 19 cases.

Twenty of the mattress samples would be expected to ignite.

---

2 CPSC Briefing Paper, "Bedding Fires", October 3, 1984.

All except one of these samples were determined to be pre-standard construction; although in some cases the reported age would indicate a mattress that should be complying with the standard. This was true in eight of the 20 samples we determined would be expected to ignite from a cigarette. These eight samples were made using pre-standard constructions but the reported age would lead one to assume a post-standard construction and, therefore, a more cigarette ignition resistant mattress. In some cases, an inaccurate indication of construction and materials and therefore expected cigarette ignition may result if only the reported age of a sample is considered when analyzing the data.

This analysis reveals that for the most part the mattresses involved in these cigarette ignited fires are constructed with pre-standard construction techniques and materials and, therefore, would be expected to ignite if exposed to a burning cigarette. A 1984 CPSC study[2] also found that most of the mattresses involved in cigarette fires were pre-standard construction.

A similar analysis of upholstered furniture was not possible due to the more complex geometry of upholstered furniture constructions, the uncertainty of exact locations from which samples were taken and incomplete samples obtained from those locations.

CONCLUSIONS AND RECOMMENDATIONS

The reported age of a sample is often an unreliable indicator of materials or construction of a product. Complete samples are essential to determine expected conformance or nonconformance of a mattress sample with the Mattress Flammability Standard. This is also true of upholstered furniture samples although it may be more difficult to determine expected conformance/nonconformance with the UFAC Voluntary program.

Suggestions for any future studies include the following:

1. A more thorough training session with an emphasis on the "ideal" sample. The "ideal" sample would include all layers of the sample, clearly identified, a short narrative describing the fire damage and photographs of the sample at the fire scene. The importance of collecting the most complete sample possible should be stressed.

2. An emphasis on reporting the accurate age of the sample with discussion on the effective dates of the two flammability standards, (Mattress Flammability Standard and UFAC Phase 2 Voluntary Upholstered Furniture Program). The discussion should include the fact that as a result of these two standards, more cigarette ignition resistant materials and combinations of materials are now being used in mattresses and upholstered furniture.

Attachments

TABLE 1

DATA COLLECTION REPORTS RECEIVED WITH SAMPLES

SAMPLE NO.	FIRE IN. NO.	CITY, STATE	ITEM	AGE	LOCATION OF IGNITION	COMMENTS
E-5965276	87-031353	Baltimore, MD	mattress	unknown	center of mattress	fell asleep smoking
E-5965279	87-026521	Baltimore, MD	mattress	unknown	center	
G-5960519	87-030601	Baltimore, MD	mattress	unknown	mid.-edge	
G-5962529	87-020608	Baltimore, MD	mattress	unknown	head of mattress	drinking and smoking
G-5962539	87-024394	Baltimore, MD	mattress	unknown	center	
G-5962540	87-026091	Baltimore, MD	mattress	unknown	middle	smoking in bed
I-5966404-A	87-035005	Baltimore, MD	mattress	unknown	center of mattress	fell asleep smoking
I-5966402-A	87-034267	Baltimore, MD	mattress	unknown	corner of mattress	fell asleep smoking
I-5966401-A	87-032625	Baltimore, MD	mattress	unknown	top of mattress	
I-5966410-A	87-041251	Baltimore, MD	mattress	unknown	edge	fell asleep smoking
I-5966415-A	87-043737	Baltimore, MD	mattress	unknown	mat. pad/top of mat.	heavy smoker & drinker
I-5966418-A	87-032111	Baltimore, MD	mattress	unknown	head position	
I-5966407	6467	Cleveland, OH	mattress	unknown	top of mattress	drinking
I-5966418	7819	Cleveland, OH	mattress	unknown	top of mattress	
E-5965271	173318	Jacksonville,FL	mattress	unknown	end of mattress	unattended cigarette
I-5966416	208606	Jacksonville,FL	mattress	unknown	near pillow	fell asleep smoking
I-5966406-A	227329	Jacksonville,FL	mattress	unknown	bedding	fell asleep smoking
I-5966403	197	Los Angeles, CA	mattress	unknown	unknown	
I-5966413	0665	Los Angeles, CA	mattress	unknown	middle of mattress	
I-5966413-A	87-045036	Baltimore, MD	mattress	1 month	edge of mattress	fell asleep smoking
E-5965274	0441	Los Angeles, CA	mattress	1	middle of mattress	
G-5962530	87-021532	Baltimore, MD	mattress	2	edge of mattress	fell asleep smoking
I-5966423	1322	Los Angeles, CA	mattress	2	middle of mattress	fell asleep smoking
I-5966412-A	87-049204	Baltimore, MD	mattress	5	edge of mattress	fell asleep smok./drink.
I-5966409-A	7755	Columbus, OH	mattress	5	edge of mattress	
G-5962532	071003	Hartford, CT	mattress	5	edge of mattress	smoking in bed
G-5962535	154350	Jacksonville,FL	mattress	5	edge	
I-5966407-A	244150	Jacksonville,FL	mattress	5	side edge of mattress	
I-5966410	99	Los Angeles, CA	mattress	5	edge of mattress	smoking in bed
I-5966404	702001	Rochester, NY	mattress	5	center	
I-5966411	703270	Rochester, NY	mattress	5	top	
G-5960520	87-032341	Baltimore, MD	mattress	6	upper right head area	fell asleep smoking
I-5966414	965	Los Angeles, CA	mattress	7	unknown	
I-5966408	007001	Ft. Worth, TX	mattress	9	mid-mattress	
E-5965273	87-029710	Baltimore, MD	mattress	10	middle of mattress	
G-5962534	87-021224	Baltimore, MD	mattress	10	top of mattress	
I-5966416-A	87-042116	Baltimore, MD	mattress	10	center of mattress	
E-5965272	08202	Ft. Worth, TX	mattress	10	middle	fell asleep smoking
E-5965280	10205	Ft. Worth, TX	mattress	10	edge of mattress	drinking and smoking
I-5966415	20	Los Angeles, CA	mattress	10-15	middle of mattress	drinking
G-5960517	003629	Columbus, OH	mattress	15	edge of top	
G-5962531	04477	Columbus, OH	mattress	15	edge	smoking in bed
I-5966420-A	100	Ft. Worth, TX	mattress	15	unknown	
E-5965270	87-031552	Baltimore, MD	mattress	>15	possibly edge	drinking and smoking
I-5966406	6157	Cleveland, OH	mattress	20	undetermined	
F-5960060	05440	Columbus, OH	mattress	20	near center of blanket	fell asleep smoking
G-5962533	87-022121	Baltimore, MD	chair	unknown	seat	
I-5966403-A	87-033620	Baltimore, MD	chair	unknown	seat cushion	
I-5966405-A	87-034495	Baltimore, MD	sofa	unknown	arm	
I-5966414-A	87-093419	Baltimore, MD	sofa	unknown	crevice	fell asleep smoking
I-5966417-A	87-036459	Baltimore, MD	chair	unknown	unknown	

TABLE 1 CONT.

SAMPLE NO.	FIRE IN. NO.	CITY, STATE	ITEM	AGE	LOCATION OF IGNITION	COMMENTS
I-5966419-A	87-044220	Baltimore, MD	chair	unknown	cushion	
I-5966405	7186	Cleveland, OH	sofa	unknown	crevice	fell asleep smoking
I-5966425	110118	Cleveland, OH	sofa	unknown	seat	
I-5966420	123456	Ft. Worth, TX	chair	unknown	crevice	dropped cigarette
I-5966422	253191	Jacksonville, FL	chair	unknown	crevice	
E-5965278	702911	Rochester, NY	sofa	unknown	crevice	
I-5966411-A	87-050264	Baltimore, MD	sofa	1.5	crevice	
G-5962537	150519	Jacksonville,FL	chair	2	edge	
G-5962538	87-026430	Baltimore, MD	chair	3	crevice	
I-5966401	356	Los Angeles, CA	chair	5	middle of cushion	child lit cigarette
G-5962536	03969	San Antonio, TX	chair	5	crevice	
I-5966402	5595	Cleveland, OH	sofa	5	undetermined	
E-5965269	509	Los Angeles, CA	sofa	9	unknown	
I-5966419	7956	Cleveland, OH	sofa	10	crevice	
I-5966417	07242	Columbus, OH	sofa	10	crevice	
I-5966408-A	11183	Ft. Worth, TX	sofa	10	between cushions	dropped cigarette
I-5965275	0006	Los Angeles, CA	sofa	10	middle of cushion	
I-5966421	281978	Jacksonville, FL	sofa	>15	crevice	fell asleep smoking
I-5966412	703331	Rochester, NY	chair	20	crevice	fell asleep smoking
I-5966424	34	Los Angeles, CA	sofa	30	crevice	
G-5960518	4999	Columbus, OH	glider cush.	1	unknown	
I-5966409	313	Los Angeles, CA	sofa bed/tra	10	middle of cushion	cigarette dropped

TABLE 2

SAMPLES CONTAINING UNTREATED COTTON BATTING

SAMPLE NO.	FIRE IN. NO.	ITEM	AGE	LOCATION OF IGNITION
E-5965279	87-026521	mattress	unknown	center of mattress
G-5960519	030601 .	mattress	unknown	mid-edge
G-5962529	87020608	mattress	unknown	head of mattress
G-5962539	87-024394	mattress	unknown	center
I-5966404-A	87-035005	mattress	unknown	center of mattress
I-5966402-A	87-034267	mattress	unknown	corner of mattress
I-5966401-A	87-032625	mattress	unknown	top of mattress
I5966418-A	87-032111	mattress	unknown	head portion
I-5966407	6467	mattress	unknown	top of mattress
I-5966418	7819	mattress	unknown	top of mattress
E-5965271	173318	mattress	unknown	end of mattress
I-5966406-A	227329	mattress	unknown	bedding
I-5966403	197	mattress	unknown	unknown
E-5965274	0441	mattress	1	middle of mattress
I-5966412-A	87-049204	mattress	5	edge of mattress
I-5966409-A	7755	mattress	5	edge of mattress
I-5966410	99	mattress	5	edge of mattress
I-5966404	702001	mattress	5	center
I-5966411	703270	mattress	5	top
G-5960520	87-032341	mattress	6	upper right head area
I-5966408	007001	mattress	9	mid-mattress
G-5962534	87-021224	mattress	10	top of mattress
I-5966416-A	87-042116	mattress	10	center
E-5965272	08202	mattress	10	middle
E-5965280	10205	mattress	10	edge of mattress
I-5966415	20	mattress	10-15	middle of mattress
G-5960517	003629	mattress	15	edge of top
G-5962531	04477	mattress	15	edge
I-5966420-A	100	mattress	15	unknown
E-5965270	87-031552	mattress	>15	possibly edge
I-5966406	6157	mattress	20	undetermined
I-5966403-A	87-033620	chair	unknown	seat cushion
I-5966405-A	87-034495	sofa	unknown	arm
I-5966414-A	87-043419	sofa	unknown	crevice
I-5966419-A	87-044220	chair	unknown	cushion
I-5966425	11018	sofa	unknown	seat
I-5966420	123456	chair	unknown	crevice
I-5966422	253191	chair	unknown	crevice
I-5966402	5595	sofa	5	undetermined
I-5966419	7956	sofa	10	crevice
I-5966417	07242	sofa	10	crevice
I-5966421	281978	sofa	15+	crevice

TABLE 3

SAMPLES CONTAINING QUILTED TICKING

SAMPLE NO.	FIRE IN. NO.	AGE	LOCATION OF IGNITION	FABRIC	SECOND LAYER	THIRD LAYER
E-5965276	87-031353	unk.	center of mattress	rayon/poly	polyetherurethane	polyester-mesh
E-5965279	87-026521	unk.	center	rayon	rayon-nonwoven	polyetherurethane
I-5966402-A	87-034267	unk.	corner of mattress	rayon/cotton	foam‡	---
G-5962535	154350	5	edge	rayon	polyetherurethane	cotton-mesh
I-5966407-A	244150	5	side edge of mattress	polyester	polyetherurethane	polyester-non-woven
I-5966411	703270	5	top	rayon/cotton	cotton batting	cotton-mesh
I-5966415	20	10-15	middle of mattress	cotton	polyetherurethane	nylon-non-woven

‡foam not suitable for analysis

TABLE 4

SAMPLES CONTAINING CELLULOSIC TICKING AND UNTREATED COTTON BATTING

SAMPLE NO.	FIRE IN. NO.	AGE	LOCATION OF IGNITION	FABRIC	FILLING
G-5962539	87-024394	unk.	center	cotton	cotton
I-5966418	7819	unk.	top of mattress	rayon/cotton	cotton
I-5966406-A	227329	unk.	bedding	rayon/cotton	cotton
I-5966412-A	87-049204	5	edge of mattress	rayon/cotton	cotton
G-5960520	87-032341	6	upper right head are	cotton	cotton
G-5962534	87-021224	10	top of mattress	cotton	cotton
I-5966416-A	87-042116	10	center	rayon	cotton
E-5965280	10205	10	edge of mattress	cotton	cotton
G-5962531	04477	15	edge	cotton	cotton
I-5966420-A	100	15	unknown	rayon/cotton	cotton

TABLE 5

SAMPLES CONTAINING SHREDDED FOAM

SAMPLE NO.	FIRE IN. NO.	AGE	LOCATION OF IGNITION	FABRIC	FILLING MATERIAL
G-5962537	150519	2	edge	rayon	polyetherurethane
G-5962538	87-026430	3	crevice	---	polyetherurethane

TABLE 6

SAMPLES CONTAINING LIGHTWEIGHT CELLULOSIC UPHOLSTRY FABRICS

SAMPLE NO.	FIRE IN. NO.	AGE	LOCATION OF IGNITION	FABRIC	WEIGHT OZ/YD2
I-5966424	34	30	crevice	rayon	8.6
G-5960518	4999	1	unknown	cotton	7.6

TABLE 7

ANALYSIS OF MATTRESS SAMPLES TO DETERMINE EXPECTED IGNITIONS

SAMPLE NO.	REP. AGE	SAMPLES RECEIVED	FIBER,FILLING IDENTIFICATION	TYPE	LOCATION OF IGNIT.	POSSIBLE REASON FOR IGNITION	CONST. PRE/POST STANDARD	EXP TO IGNITE
E-5965276	unk.	quilted ticking	rayon/poly tick polyetherurethane polyester mesh	damask 0.3 inches open weave	center of mattress	foam thickness may not have been sufficient	Post Standard	?
		tape edge	polyester	pl wv w/fl yn				
		flange	olefin	non-woven				
E-5965279	unk.	quilted ticking	rayon tick rayon fabric polyetherurethane	twill weave non-woven 0.2 inches	center	1) cellulosic ticking, 2) untreated cotton batting, 3) foam thickness may not have been sufficient to prevent heat from reaching untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
G-5960519	unk.	filling	cotton	no borate	middle	blanket may have ignited In a 1985 CPSC Bedding Fire Test Program-Part III, the combination of a cotton woven bedspread (9.5 oz/yd2) (2, 3 & 4 layers) and a bare complying mattress ignited when tested	???	?
		blanket	cotton	novelty weave 11.0 oz/yd2	edge			
G-5962529	unk.	filling	cotton	no borate	head of mattress	???	???	?
		fiber pad	sisal					
		fabric	cotton	pl. weave				
G-5962539	unk.	ticking	cotton	twill weave (8.4 oz/yd2)	center of mattress	1) cellulosic ticking, 2) untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
G-5962540	unk.	LABORATORY UNABLE TO IDENTIFY, SAMPLE WAS TOO BADLY DECOMPOSED/CHARRED						
I-5966404-A	unk.	filling	cotton	no borate	center of mattress	???	???	?
I-5966402-A	unk.	quilted ticking	rayon/cotton tick foam	damask 0.2 inches	corner of mattress	1) cellulosic ticking, 2) untreated cotton batting, 3) foam thickness may not have been sufficient to prevent heat from reaching untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
		fiber pad	sisal					
I-5966401-A	unk.	filling	cotton	no borate	top of mattress	???	???	?
		fabric	poly/cotton	sheet, 3.5 oz/yd2				

TABLE 7 CONT.

SAMPLE NO.	REP. AGE	SAMPLES RECEIVED	FIBER,FILLING IDENTIFICATION	TYPE	LOCATION OF IGNIT.	POSSIBLE REASON FOR IGNITION	CONST. PRE/POST STANDARD	EXP TO IGNITE
I-5966410-A	unk.	LABORATORY UNABLE TO IDENTIFY, SAMPLE WAS TOO BADLY DECOMPOSED/CHARRED						
I-5966415-A	unk.	foam	polyetherurethane	3.0 inches	mattress pad, top of mattress	???	???	?
I-5966418-A	unk.	filling	cotton	no borate	head portion	???	???	?
I-5966407	unk.	filling fiber pad	cotton sisal	no borate	top of mattress	???	???	?
I-5966418	unk.	ticking	rayon/cotton	twill weave (9.0 oz/yd2)	top of mattress	1) cellulosic ticking, 2) untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
E-5965271	unk.	filling foam fiber pad	cotton polybutadiene sisal	no borate 2.0 inches	end of mattress	???	???	?
I-5966416	unk.	foam filling	polyetherurethane polyester	resonated pillow	near pillow	???	???	?
I-5966406-A	unk.	ticking	rayon/cotton	damask (8.0 oz/yd2)	bedding	1) cellulosic ticking, 2) untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
I-5966403	unk.	filling	cotton	no borate	unknown	???	???	?
I-5966413	unk.	ticking	rayon/cotton	twill weave	middle of mattress	???	???	?
I-5966413-A	< 1	ticking foam fiber pad	polyvinylacetate polyetherurethane sisal	0.9 inches	edge of mattress	???	Post Standard	NO
E-5965274	1	filling fabric	cotton poly/cotton	no borate sheet	middle of mattress	???	???	?
G-5962530	2	foam	polyetherurethane		edge	???	???	?
I-5966423	2	ticking	poly/cotton	twill weave (9.3 oz/yd2)	middle of mattress	???	Post Standard	NO
		foam	polybutadiene	1.2 inches lt. green				

TABLE 7 CONT.

SAMPLE NO.	REP. AGE	SAMPLES RECEIVED	FIBER,FILLING IDENTIFICATION	TYPE	LOCATION OF IGNIT.	POSSIBLE REASON FOR IGNITION	CONST. PRE/POST STANDARD	EXP TO IGNITE
I-5966412-A	5	ticking	rayon/cotton	satin weave	edge of	1) cellulosic ticking,	Pre	YES
		filling	cotton	no borate	mattress	2) untreated cotton batting	Standard	
		fiber pad	sisal					
I-5966409-A	5	filling	cotton	no borate	edge of	???	???	?
		foam	polyetherurethane	1.3 inches	mattress			
G-5962532	5	fiber pad	sisal		edge	???	???	?
G-5962535	5	quilted ticking	rayon tick	plain weave	edge	1) cellulosic ticking	Pre	YES
			polyetherurethane	0.2 inches		2) cotton mesh in quilt	Standard	
			cotton mesh	open weave		panel, 3) untreated cotton		
		tape edge	cotton	pl wv w/met fl	yn	tape		
		foam	polyetherurethane	3.0 inches				
		foam	polybutadiene					
I-5966407-A	5	quilted ticking	polyester tick	damask (3.5 oz/yd2)	side edge of mattress	foam thickness may not have been sufficient	Post Standard	NO
			polyetherurethane	0.4 inches				
			polyester	non-woven				
		foam	polyetherurethane	0.8 inches				
I-5966410	5	ticking	polyester	stitchbonded (7.0 oz/yd2)	edge	1) untreated cotton batting directly under ticking	???	YES
		filling	cotton	no borate				
I-5966404	5	ticking	polyester	stitchbonded	center	???	Post	NO
		fabric	polyester	non-woven (1.4 oz/yd2)			Standard	
		flange	polyester	non-woven				
		foam	polyetherurethane	0.7 inches				
		filling	cotton	no borate				
		fiber pad	sisal					
G-5960520	6	ticking	cotton	plain weave (6.9 oz/yd2)	upper rt. head area	1) cellulosic ticking, 2) untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
I-5966414	7	fiber pad	sisal		unknown	???	???	?
I-5966408	9	filling	cotton	no borate	mid	???	???	?
		fiber pad	sisal		mattress			
		fabric	poly/cotton	sheet				
E-5965273	10	fiber pad	sisal		middle of	???	???	?
		fabric	wool	felt, blanket	mattress			

TABLE 7 CONT.

SAMPLE NO.	REP. AGE	SAMPLES RECEIVED	FIBER,FILLING IDENTIFICATION	TYPE	LOCATION OF IGNIT.	POSSIBLE REASON FOR IGNITION	CONST. PRE/POST STANDARD	EXP TO IGNITE
G-5962534	10	ticking	cotton	twill weave	top of	1) cellulosic ticking,	Pre	YES
		filling	cotton	no borate	mattress	2) untreated cotton batting	Standard	
		fabric	poly/rayon	sheet				
		fabric	polyester	open weave				
I-5966416-A	10	ticking	rayon	plain weave	center	1) cellulosic ticking,	Pre	YES
		filling	cotton	no borate		2) untreated cotton batting	Standard	
		fiber pad	sisal					
E-5965272	10	filling	cotton	no borate	middle	???	???	?
E-5965280	10	ticking	cotton	twill weave (13.2 oz/yd2)	edge of mattress	1) cellulosic ticking, 2) untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
I-5966415	10-15	quilted ticking	cotton tick	twill weave	middle of	1) cellulosic ticking,	Pre	YES
			polyetherurethane	0.1 inches	mattress	2) untreated cotton batting,	Standard	
			nylon	non-woven		3) foam thickness may not		
		filling	cotton	no borate		have been sufficient to pre-		
		foam	polyetherurethane	0.2 inches		vent heat from reaching untreated cotton batting		
G-5960517	15	filling	cotton	no borate	edge of top	1) old age reported,	Pre	YES
		fabric	cotton mesh	open weave		2) cotton mesh, 3) untreated cotton batting	Standard	
G-5962531	15	ticking	cotton	twill weave (6.8 oz/yd2)	edge	1) cellulosic ticking, 2) untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
I-5966420-A	15	ticking	rayon/cotton	twill weave (5.2 oz/yd2)	unknown	1) cellulosic ticking, 2) untreated cotton batting	Pre Standard	YES
		filling	cotton	no borate				
E-5965270	>15	filling	cotton	no borate	poss. edge of mattress	1) old age reported, 2) untreated cotton batting	Pre Standard	YES
I-5966406	20	filling	cotton	no borate	undet.	1) old age reported, 2) untreated cotton batting	Pre Standard	YES
		fiber pad	sisal					
F-5960060	20	ticking	cotton	twill weave (8.7 oz/yd2)	near center of	1) cellulosic ticking, 2) old age reported,	Pre Standard	YES
		blanket, quilted	poly/cotton fabric	plain weave	blanket	3) quilted cellulosic blanket In a 1984 CPSC Bedding Fire Test Program-Part II, the combination of a quilted square, (representing a home-made quilt) and a complying mattress ignited when tested.		
			cotton filling	no borate				
			cotton fabric	plain weave				

8

Technical Study Group Cigarette Safety Act of 1984