UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
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Memorandum

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THROUGH: Russell Roegner, Ph.D., Associate Executive Director
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SUBJECT : Upholstered Furniture Addressable Fire Loss Estimates for 1999 - 2002

Introduction

In October 2003, the U.S. Consumer Product Safety Commission (CPSC) issued an advance notice of proposed rule making (ANPR) to address the risk of upholstered furniture fires from ignitions by small open flames and/or smoldering cigarettes [1]. This proceeding is conducted under the authority of the Flammable Fabrics Act (FFA). Under the FFA, the CPSC must consider the costs and benefits of a proposed rule. The benefits from an upholstered furniture rule would be in the reduction in fires losses from the adoption of a standard. These losses include deaths, injuries, and property loss from upholstered furniture fires.

CPSC staff publishes reports of annual residential fire loss estimates [2,3]. These reports provide fire loss estimates for a range of consumer products. Table 1 displays the estimated losses associated with upholstered furniture broken down by year based on the most recent report [3]. Upholstered furniture accounted for an estimated annual average 9,000 fires, 520 civilian deaths, 1,040 civilian injuries, and $242 million dollars in property damage for the years 1999 to 2002. Upholstered furniture fires are associated with the largest number of fire deaths among products under CPSC's jurisdiction.

It is not expected that all of the fire losses associated with upholstered furniture would be eliminated under the 2005 CPSC staff's draft standard. First, the staff's draft standard addresses only fires from small open flame and/or smoldering cigarette ignitions of upholstered furniture. Small open flame ignitions include ignitions from such sources as matches, lighters, and candles. Ignitions from other sources such as electric appliances would not be addressable, for example. Also, fires arising from arson are assumed not to be addressable.

Table 1: Estimated Upholstered Furniture Fire Losses in 1999 to 2002.

Year	*Fires*	*Civilian Deaths*	*Civilian Injuries*	*Property Loss (Millions)*
1999	9,300	430	1,090	$231
2000	9,000	580	1,120	$269
2001	9,100	620	1,020	$217
2002	8,600	460	940	$252
Average	9,000	520	1,040	$242

Source: U.S. Consumer Product Safety Commission from data obtained from the U.S. Fire Administration and the National Fire Protection Association.
Notes: Estimates include residential structure losses only and exclude losses involving arson. Estimated fires rounded to the nearest 100. Estimated deaths and injuries rounded to the nearest 10. Estimated property loss rounded to the nearest million. Averages are based on the unrounded estimates.

Second, some fraction of losses from addressable fires may not be eliminated under the staff's draft standard. The CPSC staff's draft standard is designed to reduce the progression and severity of upholstered furniture fires. The draft standard places performance criteria on many of the component materials of furniture, including upholstery fabrics, fillings, and fire barriers. Even with reduced progression and severity, some upholstered furniture losses would not be eliminated.

This memo presents estimates of upholstered furniture fire losses that are addressable under the CPSC staff's draft standard. These losses represent the collection of losses that would be affected by the standard. There are several notes of caution in using the fire loss estimates given in this memo. In 1999, one of the two data sources used in the estimation of fire losses, the National Fire Incident Reporting System (NFIRS), underwent a major revision. Comparisons of estimates for years prior to 1999 from previous reports with estimates from 1999 and onward in the present memo should be done with caution. Also, there have been some revisions in the processing of the master file used to produce the 1999 estimates [3]. Therefore, there are some small differences between the 1999 estimates in the present memo and those from a previous memo that included addressable losses for the years 1995 to 1999 [4].

Upholstered Furniture Fire Loss Estimates

Tables 2 to 5 provide the addressable fire, death, injury, and property loss estimates for the years 1999 to 2002. Tables 6 and 7 break down the yearly averages of addressable death and injury loss estimates by the age of the victim.

Over the four years of 1999 to 2002, there were estimated yearly average addressable losses of 4,800 fires, 360 deaths, 740 injuries, and 133 million dollars property damage. For each loss measure, the loss estimates associated with smoking materials were substantially larger than those associated with small open flames. However, for victims under the age of 15, there appear to be more deaths and injuries from small open flame ignitions than from smoking material ignitions.

Table 2: Estimated Addressable Upholstered Furniture Fires 1999 to 2002.

Year	*Smoking Materials*	*Small Open Flames*	*Total*
1999	4,200	1,400	5,600
2000	3,900	1,200	5,100
2001	3,300	1,200	4,500
2002	2,800	1,200	4,000
Average	3,600	1,300	4,800

Source: U.S. Consumer Product Safety Commission from data obtained from the U.S. Fire Administration and the National Fire Protection Association.
Notes: Estimates include residential structure losses only and exclude losses involving arson. Estimated fires rounded to the nearest 100. Totals and averages are based on the unrounded estimates.

Table 3: Estimated Addressable Upholstered Furniture Civilian Deaths 1999 to 2002.

Year	*Smoking Materials*	*Small Open Flames*	*Total*
1999	320	20	340
2000	310	120	430
2001	380	50	430
2002	190	40	240
Average	300	60	360

Source: U.S. Consumer Product Safety Commission from data obtained from the U.S. Fire Administration and the National Fire Protection Association.
Notes: Estimates include residential structure losses only and exclude losses involving arson. Estimated deaths rounded to the nearest 10. Totals and averages are based on the unrounded estimates.

Table 4: Estimated Addressable Upholstered Furniture Civilian Injuries 1999 to 2002.

Year	*Smoking Materials*	*Small Open Flames*	*Total*
1999	560	300	860
2000	550	300	840
2001	470	220	680
2002	330	220	550
Average	480	260	740

Source: U.S. Consumer Product Safety Commission from data obtained from the U.S. Fire Administration and the National Fire Protection Association.
Notes: Estimates include residential structure losses only and exclude losses involving arson. Estimated injuries rounded to the nearest 10. Totals and averages are based on the unrounded estimates.

Table 5: Estimated Addressable Upholstered Furniture Property Loss (Millions) 1999 to 2002.

Year	*Smoking Materials*	*Small Open Flames*	*Total*
1999	$96	$35	$130
2000	$123	$35	$158
2001	$81	$42	$123
2002	$62	$58	$121
Average	$91	$42	$133

Source: U.S. Consumer Product Safety Commission from data obtained from the U.S. Fire Administration and the National Fire Protection Association.
Notes: Estimates include residential structure losses only and exclude losses involving arson. Estimated property loss rounded to the nearest million. Totals and averages are based on the unrounded estimates.

Table 6: Estimated Addressable Upholstered Furniture Civilian Deaths 1999 to 2002 Average by Age of Victim.

Victim Age (Years)	*Smoking Materials*	*Small Open Flames*	*Total*
< 5	10	20	30
5 - 14	10	10	30
15 - 64	180	20	190
65+	100	0	110
Total	300	60	360

Source: U.S. Consumer Product Safety Commission from data obtained from the U.S. Fire Administration and the National Fire Protection Association.
Notes: Estimates include residential structure losses only and exclude losses involving arson. Estimated deaths rounded to the nearest 10. Totals and averages are based on the unrounded estimates.

Table 7: Estimated Addressable Upholstered Furniture Civilian Injuries 1999 to 2002 Average by Age of Victim.

Victim Age (Years)	*Smoking Materials*	*Small Open Flames*	*Total*
< 5	20	50	70
5 - 14	10	30	50
15 - 64	350	160	510
65+	90	20	120
Total	480	260	740

Source: U.S. Consumer Product Safety Commission from data obtained from the U.S. Fire Administration and the National Fire Protection Association.
Notes: Estimates include residential structure losses only and exclude losses involving arson. Estimated injuries rounded to the nearest 10. Totals and averages are based on the unrounded estimates.

Methodology

The 1999 – 2002 Residential Fire Loss Estimates report [3] describes the general methodology used by CPSC staff to derive national fire loss estimates and discusses some of the recent changes in the data sources. Refer to the report for details on the general methodology. That methodology and the specific methodology employed to derive addressable upholstered furniture losses are summarized here.

The fire loss estimates given in this report are derived from two data sources: the National Fire Protection Association (NFPA) annual survey of fire departments and the U.S. Fire Administration (USFA) National Fire Incident Reporting System (NFIRS). The NFPA survey provides national estimates for the U.S. of aggregate fires, deaths, injuries, and property losses. NFIRS is a compilation of standardized incident reports submitted by U.S. fire departments to states that in turn submit them to the USFA.

NFIRS is neither a census nor a probability sample of fire incidents. Not all fire departments and states participate in NFIRS and participation varies from year to year. However, NFIRS incidents are believed to be representative of U.S. incidents. To derive national estimates of fire losses based on NFIRS, the NFIRS incidents are weighted by the ratio of the NFPA national estimate to the total number of NFIRS incidents for the loss. Only residential structure fires are considered for the purpose of the CPSC staff's Annual Report and this memo.

NFIRS summarizes each fire incident using a set of variables and associated codes [5]. Table 8 gives the variables used for the present analysis. The first three variables in the table, *Item First Ignited*, *Heat Source*, and *Cause of Ignition*, are the primary variables used to identify the fires in the scope of the analysis. These fires are fires in which the first item ignited was upholstered furniture, the heat source was small open flames or smoldering cigarettes, and the cause was not arson. Tables A1, A2, and A3 in the appendix give the specific codes for these variables and how they were classified in the analysis.

A secondary set of variables, *Equipment Involved in Ignition*, *Factors Contributing to Ignition*, *Area of Fire Origin*, and *Type of Material First Ignited*, was used to further refine the identification of the fires in scope of the analysis and eliminate coding inconsistencies. For some codes of these variables, the corresponding fire would not be addressable by the staff's draft standard. For example, electrical fires would not be considered addressable. Some codes of these variables suggest coding inconsistencies. For example, an area of origin of "chimney" appears implausible. The decision was made that such coding inconsistencies would be treated as out of scope. Tables A4 to A7 in the appendix give the specific codes for these variables and how they were classified in the analysis.

Table 8: NFIRS Variables Used in Estimating Fires Losses.

Variable Names	Description/Example
Item First Ignited	Functional description or use of the material, e.g., upholstered furniture
Heat Source	Source of heat that ignited fire, e.g., match
Cause of Ignition	General cause resulting in heat source igniting combustible material, e.g., unintentional
Equipment Involved in Ignition	Identity of equipment involved, e.g., space heater
Factors Contributing to Ignition	Contributing factors in heat source igniting combustible material, e.g., equipment overload
Area of Fire Origin	The room or space where fire originated, e.g., kitchen
Type of Material First Ignited	Composition of material ignited, e.g., fabric
Age	Age of casualty

The NFIRS variables include codes indicating the actual code of the variable is unknown. For the three primary NFIRS variables, these unknowns were allocated to the known values by a procedure known as raking [6]. The procedure maintains the marginal distribution of the known codes for each variable.

For the secondary NFIRS variables, only known values were used to declare a fire out-of-scope. Among incidents in which the primary variables indicated that the incident was in-scope, there was only a small percentage in which the known codes of the secondary variables implied that the incident was out-of-scope. In the interest of not increasing the complexity of the raking procedure, the secondary variables were not included in the raking procedure. Equivalently, the unknown codes for the secondary variables were considered in scope. This is reflected in Tables A4 to A7.

Appendix A: NFIRS Variable Codes

Table A1: Item First Ignited Codes.

Description	**Code**	**Scope**
Upholstered sofa, chair, vehicle seat	21	In/Upholstered Furniture
Undetermined item ignited	UU	Unknown
Other	All other codes	Out

Table A2: Heat Source Codes.

Description	**Code**	**Scope**
Cigarette	61	In/Smoking Materials
Pipe or cigar	62	In/Smoking Materials
Heat from undetermined smoking	63	In/Smoking Materials
Match	64	In/Small Open Flames
Cigarette lighter	65	In/Small Open Flames
Candle	66	In/Small Open Flames
Undetermined heat source	UU	Unknown
Other	All other codes	Out

Table A3: Cause of Ignition Codes.

Description	**Code**	**Scope**
Intentional	1	Out
Unintentional	2	In
Failure of equipment of heat source	3	In
Act of nature	4	In
Cause under investigation	5	Unknown
Cause undetermined after investigation	U	Unknown

Table A4: Equipment Involved in Ignition Codes.

Description	Code	Scope
Heating, Ventilating & Systems Air Conditioning	100 – 152	Out
Electrical Distribution, Lighting & Power Transfer	200 – 263	Out
Shop Tools & Industrial Equipment	300 – 377	Out
Commercial & Medical Equipment	400 – 451	Out
Garden Tools & Agricultural Equipment	500 – 538	Out
Kitchen & Cooking Equipment	600 – 656	Out
Electronic and Other Electrical Equipment	700 – 757	Out
Personal & Household Equipment	800 – 897*	Out
Other equipment involved in ignition	000	Out
Equipment involved in ignition undetermined	UUU	In
Other	All other codes	In

*Excludes 872 “Charcoal lighter” and 873 “Cigarette lighter, pipe lighter”.
Note: Bold indicates range of codes.

Table A5: Factors Contributing to Ignition Codes.

Description	Code	Scope
Cutting, welding too close to combustible	13	Out
Flammable liquid or gas spilled	14	Out
Improper fueling technique	15	Out
Flammable liquid used to kindle fire	16	Out
Washing part, painting with flammable liquid	17	Out
Improper container or storage	18	Out
Mechanical Failure, Malfunction	20 – 27	Out
Electrical Failure, Malfunction	30 – 37	Out
Equipment overloaded	54	Out
Undetermined factor contributing to ignition	UU	In
Other	All other codes	In

Note: Bold indicates range of codes.

Table A6: Type of Material First Ignited Codes.

Description	Code	Scope
Flammable Gas	10 – 19	Out
Flammable, Combustible Liquid	20 – 29	Out
Volatile Solid, Chemical	30 – 39*	Out
Cork	52	Out
Hay, straw	54	Out
Coal, coke, briquettes, peat	56	Out
Food, starch	57	Out
Tobacco	58†	Out
Wood Paper	60 – 69	Out
Wig	75	Out
Human hair	76	Out
Material Compounded with Oil	80 – 89	Out
Multiple types of material first ignited	99	Out
Undetermined type of material	UU	In
Other	All other codes	In

*Excludes code 33 “Polish, paraffin, wax” when *Heat Source* is 66 “Candle, taper”.
† Excludes code 58 “Tobacco” when *Heat Source* is 61 “Cigarette” or 62 “Pipe or cigar”.
Note: Bold indicates range of codes.

Table A7: Area of Origin Codes.

Description	Code	Scope
Escalator	4	Out
Dumbwaiter or elevator shaft	51	Out
Conduit, pipe, utility, or ventilation shaft	52	Out
Light shaft	53	Out
Chute; laundry or mail, excluding trash chutes	54	Out
Duct: hvac, cable, exhaust, heating, or AC	55	Out
Chimney	57	Out
Conveyor	58	Out
Wall surface	75	Out
Wall surface: exterior	76	Out
Awning	78	Out
Transportation, Vehicle Area	80 – 89	Out
Undetermined area of origin	UU	In
Other	All other codes	In

Note: Bold indicates range of codes.

References

[1] Federal Register, Vol. 68, No. 205, pps. 60629 – 60632, 2003.

[2] Revised Residential Fire Loss Estimates, 1980 – 1998, L. Smith, J. Mah, U.S. Consumer Product Safety Commission, 2002.

[3] 1999 Revised – 2002 Residential Fire Loss Estimates, R. Chowdhury, M. Green, D. Miller, L. Smith, U.S. Consumer Product Safety Commission, 2005.

[4] Upholstered Furniture Addressable Fire Loss Estimates for 1995 to 1999, M. Levenson, U.S. Consumer Product Safety Commission, 2004.

[5] National Fire Incident Reporting System Version 5 Design and Documentation, U.S. Fire Administration, 2002.

[6] A SAS Macro for Balancing a Weighted Sample, M. Battaglia, D. Hoaglin, D. Izrael, SAS Users Group International 25th Annual Conference, Paper #258-25, 2000.