NBS TECHNICAL NOTE 817

Kitchen Ranges in Fabric Fires

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Kitchen Ranges in Fabric Fires

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KITCHEN RANGES IN FABRIC FIRES

Allan K. Vickers

Kitchen ranges played a major role in the 1616 fabric accident case histories recorded in the Flammable Fabrics Accident Case and Testing System as of May 1972. They accounted for 214 or 35 percent of the direct garment ignitions in FFACTS. Female victims outnumbered males by 3 to 1; females under 16 and over 65 were particularly heavily represented. Reaching over and leaning against the range caused the majority of the garment ignitions. Shirts, robes, pajamas, nightgowns and dresses were the most frequently ignited garments. Thirty-four victims died from injuries resulting from garment ignitions from ranges; 24 of these fatalities were people over 65 years old.

Key words: Accidents; burns; FFACTS; flammable fabrics; garments; ignition sources; injuries; kitchen ranges.

1. INTRODUCTION

As of May 14, 1973, the Flammable Fabrics Act is being administered by the Consumer Product Safety Commission. The National Bureau of Standards (NBS) furnishes technical support to the Commission in the areas of hazard analysis, flammability research and product flammability test development. Accordingly, the Hazard Analysis Section, Fire Technology Division, NBS, reviews available fabric fire data to determine and understand the hazards leading to fire losses.

As a part of this task, fabric fire accident data recorded in the NBS Flammable Fabrics Accident Case and Testing System (FFACTS), a subsystem of the National Fire Data System, is continually reviewed both to establish candidate priorities for national mandatory standards for the flammability of fabric products and to provide the basis for the development of realistic tests which approximate the hazards in real life situations. This latter function has led to a study of the ignition sources which most commonly ignite fabric products. A report on the role of matches and lighters in fabric fires has previously been issued.[1]

Kitchen ranges are the most frequent single ignition source among direct garment ignition incidents currently incorporated in the FFACTS data base. Accordingly, the Fire Technology Division has initiated a cooperative study with representatives of electric and gas range manufacturers and commercial certification agencies to determine what design changes in kitchen ranges could be implemented on a voluntary

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[1] Slater, J. A., Buchbinder, B. and Tovey, H., Matches and Lighters in Flammable Fabric Incidents: The Magnitude of the Problem, Nat. Bur. Stand.(U.S.), Tech. Note 750 (Dec. 1972).

basis to lessen the hazards associated with their operation. This paper summarizes the kitchen range accident data in FFACTS in order to provide further understanding of the hazards associated with kitchen ranges. It is hoped that this information will prove useful both in determining what design changes may be appropriate and beneficial to the public and in increasing public awareness of some of the hazards which could be avoided with more careful range usage.

1.1 The Flammable Fabrics Accident Case and Testing System

The FFACTS data base is derived from case history reports on accidental fires, involving fabric products, investigated by Consumer Product Safety Commission (CPSC) investigators using questionnaires developed in cooperation with the NBS Fire Technology Division (FTD). These reports, along with the remains of fabric products involved, are sent to the FTD Hazard Analysis Section for analysis and testing. These incidents are not selected on a statistical basis and they do not, therefore, constitute a statistically representative sample of all fabric fire accidents in the United States. Nevertheless, they represent events investigated without known preference and may be roughly representative of incidents reported to the agencies from which the CPSC obtains accident data.

The FTD processes the reports and fabric samples received from CPSC, through FFACTS. The procedures under FFACTS include reviewing and screening of incident reports, laboratory testing and characterization of the fabric products involved in the accidents, data encoding, formatting, editing, and entry into a computer master file. Over 130 data elements are coded for each fire accident case. They include the time and location of the accident, personal and socio-economic facts about the victim, extent of injury and losses, the sequence of events leading to the accident, and the nature of involvement of the fabric products. Data derived from laboratory tests performed on the fabric product remnants are also encoded, including fabric construction and fiber content, and the results of flammability tests.

Data in the computer file are tabulated and analyzed to provide quantitative information on the relative frequencies of involvement of different fabric products, ignition sources and other parameters, and to identify trends and significant interrelationships between parameters.

2. IGNITION SOURCE DATA

As of May 1, 1972, the FFACTS data base contained 1616 case histories stemming from 1571 different fabric fire incidents. The ignition source is known for all but 84 of these incidents.

Relatively few different kinds of ignition sources account for the vast majority of the fabric fires in FFACTS.[2] "Matches and lighters" provided the initial heat source for 356 incidents, more than any other ignition source in FFACTS. "Cigarettes and unknown smoking materials" ranks second, accounting for 333 fires, while "kitchen ranges", the ignition source for 267 fabric fires, is third when all the incidents in the data base are considered. However, when only those incidents in which garments are directly ignited from the initial heat source are considered (i.e., incidents in which a garment is the first fabric item ignited and in which no flammable liquids or other intermediary materials are involved), kitchen ranges become the predominant ignition source, accounting for over 35 percent of such incidents in FFACTS. These data are shown in table 1.

In table 1, each of the ignition source categories, with the exception of kitchen ranges, shows a significant drop between the number of incidents in the first column (in which all fabric fire incidents are considered) and the number of incidents in the second column (in which only direct garment ignition incidents are considered). For "open fires" and "space heaters, water heaters, and furnaces", the totals differ primarily because of the frequent involvement of intermediary materials (particularly flammable liquids) in these incidents. "Cigarettes and unknown smoking materials" incidents generally involve the ignition of bedding or other furnishings, not garments. Flammability experiments at NBS have failed to obtain direct garment ignition from a burning cigarette. The 54 direct garment ignitions attributed to this category fall under the "unknown smoking materials" classification and it is presumed unlikely that these were cigarette ignitions. For the "matches and lighters" and "other" categories, both the frequent involvement of intermediary materials and the initial ignition of bedding or other furnishings account for the large differences between the two columns of table 1. Unlike the other ignition source categories, "kitchen ranges" show only a slight difference between total ignitions and direct garment ignitions; eighty percent of the range incidents involved garments ignited directly from the range itself.

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[2] An earlier report, NBS Report #10629, Ignition Sources in Accident Cases Involving Flammable Fabrics, presented a preliminary summary of the role of ignition sources in FFACTS incidents, but was subject to restricted distribution due to its preliminary nature.

Table 1. Ignition Sources for FFACTS Incidents
(FFACTS May 1972)

Ignition Source Category	Total Fabric Fire Incidents in FFACTS	Total Direct Garment Ignition Incidents in FFACTS[a]
Matches and Lighters.....	356	189
Cigarettes and Unknown Smoking Materials.....	333	54
Kitchen Ranges....	267	214
Open Fires.....	170	44
Space Heaters, Water Heaters and Furnaces....	126	42
Others.....	235	55
Total Known.....	1487	598
Unknown.....	84	0
Total.....	1571	598

[a]Incidents, involving no intermediary materials in the ignition chain, in which the first fabric item ignited was a garment.

3. KITCHEN RANGE INCIDENTS DATA

3.1 Regional Distribution by Range Type

The 267 range incident reports come from 30 states and the District of Columbia. Particularly heavily represented are Massachusetts, Colorado, Michigan, and Iowa, which were former centers for FDA investigation efforts. A breakdown of the regional distribution of incidents by range type is presented in table 2.

Table 2 shows that, among FFACTS range incidents, gas ranges outnumber electric ranges by about 2 to 1. U.S. Bureau of the Census statistics on regional range-type usage for 1970 are displayed in table 3. (The median date for the FFACTS cases is October 1970.) The data in table 3 were compiled by the Gas Appliance Manufacturers' Association.

Tables 2 and 3 show roughly similar distributions of gas vs. electric ranges. However, an apparent bias in the FFACTS data base towards lower income and older housing (because of the population centers sampled by FDA) results in the FFACTS range-type distribution

approximating the 1960 range usage statistics (which reflect proportionately greater gas range usage) even more closely than the 1970 data given. As it might be expected, the range accidents in FFACTS reflect the range usage statistics of the areas from which they were reported.

Table 2. Range Type by Geographic Region[a] for FFACTS Range Incidents (with Gas and Electric Range Percentages) (FFACTS May 1972)

Geographic Region	FFACTS Incidents by Range Type							
	Electric		Gas		Subtotal Gas & Electric		Unspecified and Other	Total
	Number	Percent	Number	Percent	Number	Percent		
Northeast.....	24	29	58	71	82	100	2	84
North Central.	22	29	55	71	77	100	5	82
South.....	11	44	14	56	25	100	2	27
West.....	23	37	40	63	63	100	6	69
Total Known.	80	32	167	68	247	100	15	262
Unknown.....	1	20	4	80	5	100	0	5
Total.....	81	32	171	68	252	100	15	267

[a]Regions used are those used by the U.S. Bureau of the Census.

Table 3. Gas vs Electric Ranges by Geographic Region[a] 1970 U. S. Range Usage Statistics[b] (numbers in thousands)

Geographic Region	Ranges In Use In U.S.					
	Electric		Gas		Total Gas & Electric	
	Number	Percent	Number	Percent	Number	Percent
Northeast.....	4,897	32	10,298	68	15,195	100
North Central.	6,834	39	10,527	61	17,361	100
South.....	8,884	47	9,843	53	18,727	100
West.....	5,136	47	5,887	53	11,023	100
Total....	25,751	41	36,555	59	62,306	100

[a]Regions used are those used by the U.S. Bureau of the Census.

[b]These data were compiled from U.S. Bureau of the Census Detailed Housing Characteristics by the Gas Appliance Manufacturers Association.

3.2 Range Accident Factors

While there are over 130 possible data elements coded for each incident in FFACTS, the scope of this paper on kitchen ranges will be limited to a discussion of several major variables from which, it is felt, a more concise and less cluttered view of the kitchen range-fabric ignition hazard can be drawn. These variables include the age and sex of persons involved, the type of range, the activities of persons involved leading to the ignition, the fabric items involved and personal injuries sustained.

3.2.1 Age and Sex of Persons Involved

The 267 range incidents in FFACTS directly involved 270 people. In one incident no one was involved; two persons were involved in each of two incidents; and in another, three persons were involved. Table 4 shows the age-sex distribution of these 270 people vs. the type of range. Females were involved three times as frequently as were males. This inbalance reflects the differing range use patterns between the sexes. The most highly represented groups are females under age 16 and over age 65. Certainly, females in these age groups do not use ranges more frequently than women 16-65. However, other factors such as less familiarity with range use, in the case of the younger females, and poorer judgment and reactions in the case of both the young and the old make these people more susceptible to accidental fabric ignitions. There appears to be little overall difference in the age-sex distributions for gas vs. electric ranges. This would tend to indicate that certain age-sex groups are more or less susceptible to certain range hazards, whether the range be gas or electric.

3.2.2 Activities of Persons Involved

A major factor in understanding the hazards associated with kitchen ranges is the activity of the persons involved, prior to the fabric ignition. The following two tables show the activities of involved persons broken into ten categories. These activity categories are cross-tabulated with range type in table 5 and with the age and sex of the persons in table 6.

A few of the activity categories such as "cooking" or "occupied near range" do not specify how the fabric ignition took place but merely state the person's general activity prior to the accident. For these incidents, there was not sufficient information in the investigation reports to determine with certainty a specific chain of events. In many of these cases, particularly among the elderly, the victim was alone and died from the accident, and no one was able to fully reconstruct the incident. Most of the other categories represent a more specific action, which caused the fabric to be exposed to the ignition source.

Table 4. Age-Sex Distribution of Persons Involved in Range Incidents by Range Type (FFACTS May 1972)

Age of Persons Involved[a]	In Electric Range Incidents		In Gas Range Incidents		In Unspecified & Other Range Incidents		Total Incidents	
	Males	Females	Males	Females	Males	Females	Males	Females
0-5.....	5	8	5	16	0	2	10	26
6-10.....	2	9	5	18	0	0	7	27
11-15.....	3	8	2	12	0	0	5	20
16-20.....	1	2	5	4	1	1	7	7
21-26.....	3	7	6	10	1	0	10	17
27-35.....	1	5	4	11	2	0	7	16
36-45.....	1	4	7	7	2	2	10	13
46-55.....	1	2	3	10	0	0	4	12
56-65.....	0	4	2	7	0	1	2	12
66+.....	1	14	8	31	0	2	9	47
Total Known..	18	63	47	126	6	8	71	197
Unknown..	0	0	0	1	0	1	0	2
Total..	18	63	47	127	6	9	71	199

[a]Each of the age groups above represents approximately ten percent of the 1970 U.S. population based on 1970 Bureau of the Census statistics.

Tables 5 and 6 show two specific activities which caused the majority of the range accidents in FFACTS: namely, "reaching over or across" the range and "leaning over or against" the range. These activities span all ages, both sexes, and both principal range types.

"Reaching over or across" the range generally involved cooking. Several patterns occur repeatedly through these incidents. A victim might be removing a pan from a hot burner to a cool one, stirring something in a pot, or reaching some object on top of or over the range. The dangers involved in such normal kitchen range activities lie in the exposed heat sources - a gas flame curling around the edges of a pan, a large electric heating element not fully covered by a small pan, a hot burner momentarily uncovered while pans are being shifted. Ignition usually occurred when a dangling sleeve contacted one of the above heat sources, although in some instances a potholder or dishtowel used as a potholder brushed the heat source. In some other incidents, ignition occurred when a blousy gown, robe or shirt contacted a front burner while the victim was reaching toward the back of the range (These

incidents are included in the "reaching" category although it was the concurrent "leaning" which actually caused the fire).

"Leaning over or against" the range encompasses both cooking and non-cooking activities. About half of these incidents involved persons leaning with their backs to the range--either to warm themselves or to talk with others in the room or on the phone. The other half involved persons leaning over the range cooking, turning away from the range, or brushing over the range while walking by. Again loose, blousy garments, ties, shirttails and apron strings contacted exposed portions of hot burners. The victims often did not realize their plight until large areas of their garments were in flames.

"Climbing on or around" the range is primarily a hazard for young children although others have also been burned while climbing on counters. Young children frequently climbed directly onto the range surface to reach something intriguing on top of the range. Sometimes they turned on a burner in the process and thus ignited their clothes. "Turning the range on or off" incidents generally involved reaching over burners, although a small number of accidents in this category involved gas explosions.

There are two main types of range accidents which involve intermediary materials - grease fires and flammable vapor fires.

Nearly all the grease fires in FFACTS resulted from an unattended pan of grease left on a burner. Most of the accidents would have been far less severe, had the persons involved reacted correctly. In some instances, the pan had already burst into flame and ignited curtains, etc. by the time the person returned. More often, however, the pan was only smoking heavily, and the person tried to carry it to the sink or outside. Jostling the grease in the hot pan frequently caused it to ignite and the burning grease often spilled on the victim's clothes. Placing a lid over the pan and turning off the burner would usually have eliminated the hazard.

Flammable vapor fires generally ignited from gas rather than electric ranges. Frequently the pilot lights were a sufficient flame source to fill the entire kitchen with flames once the flammable liquid reached a high vapor concentration. Countertop contact cement was the most frequent flammable liquid involved in these accidents, although gasoline and others are also recorded. Victims of these accidents were not aware of the hazard involved. In one case, professional cabinet installers remembered to blow out the range pilots before using the contact cement, but they forgot the oven pilot. After the vapor accumulated to a sufficient concentration, the room suddenly was engulfed in flames.

The last specific activity listed in tables 5 and 6 involves persons who were "nearby when curtains, etc. over the range ignited". Curtains, dishtowels, and, in one instance, a sheet hung over the range

to dry came too close to the range burners and ignited. In one of these cases, a mother and two young children died from asphyxiation after the plastic kitchen curtains blew over the range and rapidly filled the room with smoke and flames.

Table 5. Activity of Persons Involved in Range Incidents by Range Type (FFACTS May 1972)

Activity of Persons Involved	In Electric Range Incidents	In Gas Range Incidents	In Unspecified & Other Range Incidents	Total Persons Involved
Leaning over or against range	20	50	4	74
Reaching over or across range	23	47	2	72
Turning range on or off	7	5	0	12
Climbing onto or around range	6	9	0	15
Cooking (further detail not specified	9	14	0	23
Occupied near range	4	13	0	17
Nearby when curtains, etc. above range ignited	0	7	0	7
Involved in a grease fire	10	3	7	20
Using contact cement or solvent near range	0	19	1	20
Other activity	2	5	1	8
Unknown	0	2	0	2
Total	81	174	15	270

3.2.3 Fabric Item Involvement

For the remainder of the paper, the 53 incidents involving intermediary materials and/or non-garment fabric item ignitions are eliminated from discussion. While these accidents represent significant hazards around kitchen ranges, the roles which the fabric items played in the ignition and resulting injuries are not as clear for these as for the 214 direct garment ignition incidents.

The specific garment ignited first is known for 196 of the 214 direct garment ignition incidents. Table 7 displays a breakdown by garment type of these 196 range-ignited garments, paralleled by totals of direct ignitions from all other ignition sources in FFACTS. Table 7

Table 6. Activity of Persons Involved in Range Incidents by Age and Sex
(FFACTS May 1972)

Activity of Persons Involved	Sex	Age 0-5	6-10	11-15	16-20	21-26	27-35	36-45	46-55	56-65	66+	Unknown	Sub-Total	Total
Leaning over or against range.....	F	5	3	10	1	2	5	4	5	5	6		46	74
	M		3	4	5	4	2	5		1	4		28	
Reaching over or across range.....	F	6	13	4	4	4	2	4	5	6	14	1	63	72
	M	1	2	1		1		1	1	1	1		9	
Turning range on or off.....	F	1	4	1		1					1		8	12
	M	2							2				4	
Climbing onto or around range.....	F	9	1	1							1		12	15
	M	3											3	
Cooking (further detail not specified).....	F		2	1		1					16		20	23
	M						2				1		3	
Occupied near range.....	F	2	2	1	1		2				2	1	11	17
	M	3	1			1					1		6	
Nearby when curtains, etc. above range ignited	F	1	1			1	2	1					6	7
	M	1											1	
Involved in grease fire.....	F				1	3	2	3	1	1	3		14	20
	M				1	2	1	1			1		6	
Using contact cement or solvent near range...	F	1	1			2	2		1		2		9	20
	M		1		1	2	2	3	1		1		11	
Other Activity.....	F	1		2		2	1	1			1		8	8
Unknown.....	F					1					1		2	2
Subtotal.....	F	26	27	20	7	17	16	13	12	12	47	2	199	270
	M	10	7	5	7	10	7	10	4	2	9		71	
Total.....		36	34	25	14	27	23	23	16	14	56	2	270	

shows that, when incidents involving intermediary materials are excluded, about half of the first-to-ignite robes, shirts, and pajamas in FFACTS ignited from kitchen ranges. About a third of the dresses and nightgowns which ignited first in such incidents ignited from ranges. As might be expected, there are no direct pants ignition incidents caused by a range in FFACTS, while all of the apron ignitions in the data base were caused by ranges.

Table 7. Garments Directly Ignited from Initial Heat Source[a] for Kitchen Ranges and All Other Sources (FFACTS May 1972)

Garment Type	Kitchen Range Incidents		All Other Ignition Source Incidents		Total Incidents	
	Number	Percent	Number	Percent	Number	Percent
Dresses.....	22	39	34	61	56	100
Shirts/Blouses....	50	43	67	57	117	100
Pants/Slacks.....	0	0	32	100	32	100
Pajamas.....	45	48	49	52	94	100
Nightgowns.....	23	32	48	68	71	100
Robes/Housecoats..	38	53	34	47	72	100
Aprons.....	10	100	0	0	10	100
Others.....	8	10	71	90	79	100
Total.....	196	37	335	63	531	100

[a]For incidents in which a specified garment ignited directly from an ignition source without the involvement of flammable liquid or other intermediary materials.

Table 8 shows the same 196 garments broken down by range type. Table 8 merely shows that both gas and electric range burners can and do ignite garments which come in contact with them. The electric vs. gas range distributions for the individual garment types appear to reflect more the garment-range usage patterns of the persons in the data sample rather than a comparative susceptibility of a garment type to ignite from one range type or the other.

Tables 9a and 9b break down the directly ignited garments by the victim's age and sex for gas and electric ranges. These data show that pajamas are predominantly involved with younger victims, nightgown and dress incidents are concentrated among young girls and elderly women. Robe incidents center among older women while shirt and blouse ignitions span both sexes and all ages fairly evenly. Most of these garment-age-sex patterns apply for the entire FFACTS data base, not only for range accidents.

Table 8. Directly Ignited Garments by Range Type[a]
(FFACTS May 1972)

Garment Type	Electric Range Incidents	Gas Range Incidents	Unspecified and Other Range Incidents	Total Incidents
Dresses.....	3	19	0	22
Shirts/Blouses....	14	33	3	50
Pajamas.....	24	20	1	45
Nightgowns.....	11	12	0	23
Robes/Housecoats..	11	27	0	38
Aprons.....	2	8	0	10
Others.....	1	7	0	8
Total.....	66	126	4	196

[a]For incidents in which a specified garment ignited directly from a kitchen range without the involvement of intermediary materials.

3.2.4 Personal Injuries Sustained

Table 10 shows the number of burn injuries and deaths resulting from the 214 direct garment ignition incidents. Incidents with intermediary materials involved and incidents in which fabric items other than garments ignited first are not included in this table; although there were proportionately more fatalities for these incidents than for the direct garment ignitions, many of the fatalities were caused or influenced by flammable liquids or heavy smoke.

Once a garment has ignited from a kitchen range - gas or electric - a burn injury is a near certainty for the victim. However, factors other than range type have a bearing on the severity of the burn injuries sustained. These factors include the flammability of the garments, the availability of help, and most importantly the reactions and age of the victim.

Twenty-four of the 34 fatal range-garment ignition accidents involved victims over 65 years old; 23 of these 24 were women. Most of these victims had slow reactions to their garments igniting and they often panicked. Elderly persons are also less capable of surviving the traumas of serious burn injuries. Throughout the FFACTS data base, elderly persons sustain the most serious, and most frequently fatal, injuries. Table 10 demonstrates the influence of age on injury severity.

Table 9a. Directly Ignited Garments by Age and Sex for Electric Range Incidents (FFACTS May 1972)

Garment Type	Sex	Age 0-5	6-10	11-15	16-20	21-26	27-35	36-45	46-55	56-65	66+	Total
Dresses.....	F	1	1								1	3
Shirts/Blouses....	F			1		3	2	1			1	8
	M			2	1	1	1	1				6
Robes/Housecoats..	F							1	1	2	6	10
	M	1										1
Pajamas.....	F	3	4	5		2		1		1	1	17
	M	4	2	1								7
Nightgowns.....	F	2	4	2			1			1	1	11
Aprons.....	F								1		1	2
Other.....	M										1	1
Total.....	F	6	9	8	0	5	3	3	2	4	11	51
	M	5	2	3	1	1	1	1	0	0	1	15

Table 9b. Directly Ignited Garments by Age and Sex for Gas Range Incidents
(FFACTS May 1972)

Garment Type	Sex	Age 0-5	6-10	11-15	16-20	21-26	27-35	36-45	46-55	56-65	66+	Unknown	Total
Dresses.....	F	4	5	2	1		1		1		5		19
Shirts/Blouses....	F	3	1	2	1	2		1	1	1	2		14
	M	1	3	1	2	3	1	2	1	1	4		19
Robes/Housecoats..	F			2		1	2	3	2	3	9	1	23
	M	1	1							1	1		4
Pajamas.....	F	2	6	4					2				16
	M	1		1	1	1							4
Nightgowns.....	F	4	3	1			2		1		1		12
Aprons.....	F				1		1	1	1		4		8
Other.....	F		2			1	1						4
	M				1			1			1		3
Total.....	F	13	17	11	3	6	7	5	8	4	21	1	96
	M	3	4	2	4	4	1	3	1	2	6	0	30

Table 10. Burn Injuries and Deaths by Age and Sex for Direct Garment Ignition Incidents (FFACTS May 1972)

Age	Sex	Persons Involved	Burn Injuries	Deaths
0-5.....	F	22	22	2
	M	8	8	0
6-10.....	F	25	25	1
	M	6	6	0
11-15.....	F	20	20	0
	M	5	5	0
16-20.....	F	4	3	0
	M	5	5	0
21-26.....	F	11	11	3
	M	6	6	0
27-35.....	F	10	10	1
	M	3	3	0
36-45.....	F	8	8	0
	M	6	6	1
46-55.....	F	10	10	0
	M	2	2	1
56-65.....	F	11	8	1
	M	2	2	0
66+.....	F	41	39	23
	M	7	7	1
Unknown....	F	2	1	0
	M	0	0	0
Subtotals	F	164	157	31
	M	50	50	3
Total....		214	207	34

4. SUMMARY OF FINDINGS

The 267 kitchen range-fabric fire accidents in the FFACTS data base show several common characteristics and reveal accident patterns which aid in understanding the fire hazards associated with ranges:

1) Thirty-five percent of the direct garment ignitions in FFACTS were caused by kitchen ranges. About half of the first-to-ignite shirts, pajamas, and robes and about a third of the nightgowns and dresses, involved in incidents with no intermediary materials involvement, were ignited from ranges.

2) Female victims outnumbered male victims by a 3 to 1 margin in range accidents; females under 16 and over 65 were particularly frequently involved.

3) Leaning against and reaching across the range caused the majority of the garment ignitions reported.

4) Grease and volatile liquids fires represent a significant but lesser hazard around ranges than do direct garment ignitions.

5) Ninety-seven percent of the persons involved in direct garment ignitions from ranges sustained burns and 16 percent died; 56 percent of the victims over 65 died as a result of their burns.

5. POSSIBLE SOLUTIONS

The kitchen range accident case histories recorded in FFACTS indicate that garments can easily be ignited in the course of normal range usage. While much of the problem lies in the garments, themselves, certain design modifications to the ranges could reduce the ignition hazard considerably. Conceptual designs which are currently being evaluated include the following:

1) rearrangement of burner locations to eliminate the need to reach over them,

2) various methods of eliminating exposed outer portions of burners or preventing garment contact with the exposed portions,

3) knob positioning and/or operation that would make ranges more "child-proof", and

4) burners which would tuck away when not in use.

Changes such as these, particularly if complemented by meaningful public education regarding range hazards and by better garment flammability standards, could significantly reduce one of the largest fire hazards in the country today.

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16. ABSTRACT (*A 200-word or less factual summary of most significant information. If document includes a significant bibliography or literature survey, mention it here.*)

Kitchen ranges played a major role in the 1616 fabric accident case histories recorded in the Flammable Fabrics Accident Case and Testing System as of May 1972. They accounted for 214 or 35 percent of the direct garment ignitions in FFACTS. Female victims outnumbered males by 3 to 1; females under 16 and over 65 were particularly heavily represented. Reaching over and leaning against the range caused the majority of the garment ignitions. Shirts, robes, pajamas, nightgowns and dresses were the most frequently ignited garments. Thirty-four victims died from injuries resulting from garment ignitions from ranges; 24 of these fatalities were people over 65 years old.

17. KEY WORDS (*six to twelve entries; alphabetical order; capitalize only the first letter of the first key word unless a proper name; separated by semicolons*)

Accidents; burns; FFACTS; flammable fabrics; garments; ignition sources; injuries; kitchen ranges.

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