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CONSUMER PRODUCT SAFETY COMMISSION
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Memorandum

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SUBJECT : Update on Hazards Related to Portable Electric Fans *

An estimated 20,000 residential structure fires (excluding incendiary and suspicious fires) associated with all electric fans, were attended by fire departments from 1990 through 1998. These fires resulted in an estimated 930 civilian injuries, 100 civilian deaths, and \$228 million in property loss. It is also estimated that about 4,500 (23 percent) of these fires were associated with portable electric fans. These portable fans-related incidents resulted in about 270 civilian injuries, more than 20 deaths, and about \$55 million property loss in the United States during this nine year period (Table 1)¹. Estimates for residential fire losses in 1999 are currently available. However, this is the first year in the transition process to a revised data coding scheme. The current state of the coding system does not allow for the estimation of losses due to electric fans or portable electric fans alone.

In order to obtain information about portable fan hazards, CPSC staff identified and reviewed 316 follow-up investigations of portable fan-related incidents² occurring between January 1, 1990 and December 31, 2003. These incidents were associated with structure fires,

* The views expressed here are those of the CPSC staff. They have not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

¹ Adler, Prowpitt: *Final Report on Portable Electric Fans – Fires*, May 2002, Directorate for Epidemiology, Division of Hazard Analysis, U.S. Consumer Product Safety Commission.

² While they are not a statistical sample of all incidents that may have occurred between January 1990 and December 2003, they provide useful information on the incident scenarios and fan characteristics.

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~~EXCEPT BY PETITION~~
~~RELEASING ADMIN. PROCES~~
~~WITH PORTIONS REMOVED~~

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hazards from fan blades coming apart or loose was excluded since these hazards were not the focus of this data review.

Table 1
Estimated Residential Structure Fires, Deaths, Injuries, and Property Loss
Associated with Portable Electric Fans
1990-1998

Year	Fire Estimates⁴	Death Estimates⁵	Injury Estimates⁶	Loss Estimates
1990	500	*	30	\$4.0 million
1991	600	10	40	\$9.2 million
1992	500	*	30	\$4.3 million
1993	500	10	40	\$4.2 million
1994	500	*	30	\$6.5 million
1995	400	*	20	\$5.4 million
1996	400	*	20	\$4.4 million
1997	500	*	30	\$8.6 million
1998	600	*	30	\$8.6 million
Total	4,500		270	\$55.2 million

Source: U.S. Consumer Product Safety Commission, EPHA, U.S. Fire Administration, and NFPA.

Product Description

A portable fan is a cord-connected appliance capable of being easily moved by hand from place to place. Portable fans include box fans, window box fans, dual window fans, window fans, desk/table fans, pedestal/floor fans, clip-on fans, and hassock fans among others. Information concerning the fan type, failure mode, fan age, fan material, manufacturer and safety standard, and incident scenario for each incident is presented in Tables 2 through 10.

Fan Type

Based on a review of 316 portable fan-related incidents, five hazards were identified as follows: fire (266 incidents), potential fire (29 incidents), electrocution (15 incidents), electric shock (4 incidents), and electrical hazard (2 incidents). Box fans, pedestal/floor fans, and desk/table fans were involved in about 65 percent of the total incidents. The distribution of portable fans classified by the hazards is presented in Table 2.

⁴ Rounded to nearest 100.

⁵ Rounded to nearest 10 and * denotes an estimate that is less than 5.

⁶ Rounded to nearest 10.

Table 2
Distribution of Portable Fans Classified by Hazards
January 1, 1990 – December 31, 2003

Fan Type	Total	Hazard
Box Fans	82	Fire (74), Potential Fire(5), Electrocutation (1), Electrical Hazard (2)
Pedestal/Floor Fans	67	Fire (47), Potential Fire (9), Electrocutation (9), Electrical Shock (2)
Desk/Table Fans	64	Fire (52), Potential Fire (9), Electrocutation (2), Electrical Shock (1)
Window Fans	24	Fire (22), Electrocutation (1), Electrical Shock (1)
Dual Window Fans	18	Fire (16), Potential Fire (2)
Window Box Fans	12	Fire (12)
Clip-On Fans	10	Fire (8), Potential Fire (2)
Antique Small Fans	1	Fire (1)
Hassock Fans	1	Fire (1)
Airbed Fans	1	Potential Fire(1)
Tower Fans	1	Fire (1)
Portable Fans ⁷ (Not Specified)	23	Fire (21), Potential Fire (1), Electrocutation (1)
Electric Fans ⁸ (Not Specified)	11	Fire (10), Electrocutation (1)
Electrical Product ⁹	1	Fire (1)
Total	316	Fire (266), Potential Fire (29), Electrocutation (15), Electrical Shock (4), Electrical Hazard (2)

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

Failure Modes

Based on a review of 316 portable fan-related incidents, the known failure modes associated with portable fans which resulted in fires, potential fires, electrocutions, electric shocks, or electrical hazards were mainly motors, power cords, or switches (Table 3). Specifically:

- (1) One hundred and forty four motor-related incidents occurred. Of them, 64 involved an overheated motor because the motor itself seized up, 36 involved a motor with a wiring problem or short-circuit, 32 involved a motor that overheated because the fan blade was blocked from turning by an external force, and 12 incidents involved a malfunction or overheating in the motor, but no further detail was provided.
- (2) Seventy-four incidents were associated with the fan power cord. Of them, 42 involved a cord that had a short circuit or an insulation breakdown, 21 resulted from the power cord having been repaired/replaced by owners or attached to an extension

⁷ The type of these portable fans could not be determined because of severe fire damage.

⁸ Could not determine if the fans were portable because the damage was total.

⁹ Could not determine if the incident was related to portable fan.

cord, and 11 resulted from the fan's oscillating motion causing a sharp edge on the fan to rub off the cord insulation.

- (3) The 11 switch-related incidents were associated with an electrical fault in a switch (8) or bare/damaged switch wires (3).

Table 3
Distribution of Failure Modes Classified by Hazard
January 1, 1990 –December 31, 2003

Failure Mode	Total	Hazard				
		Fire	Potential Fire	Electrocution	Electrical Shock	Electrical Hazard
Motor	144					
1. Overheated/Seized Up		54	10	0	0	0
2. Wiring/Shorted Out		32	3	1	0	0
3. Overheated/Blade Blocked ¹⁰		30	2	0	0	0
4. Overheated or malfunctioned / no further detail		12				
Fan Power Cord	74					
1. Cord Failed ¹¹		37	1	4	0	0
2. Repaired/Replaced/ Extension Cord		17	0	4	0	0
3. Oscillating Motion		3	7	0	1	0
Switch	11					
1. Electrical Fault		8	0	0	0	0
2. Bare/Damaged Wire		0	0	1	1	1
Transformer - overheated	1		1			
Undetermined	86	73	5	5	2	1
Total	316	266	29	15	4	2

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

Failed motors occurred most often in box fans (42 incidents), desk/table fans (29 incidents), and pedestal/floor fans (25 incidents); failed cords occurred most often in desk/table fans (13 incidents), pedestal/floor fans (11 incidents), and box fans (10 incidents). Failed switches occurred more frequently in pedestal/floor fans (5 incidents) and in dual window fans (4 incidents).

¹⁰ When the fans fell from furniture or were jammed by curtains, bedding, etc.

¹¹ From shorting out, breakdown of insulation, being stepped on, being wedged between objects, etc.

Fan Age

According to trade experts as reported in *Appliance*, a trade publication, the average life expectancy of an electric fan is 11 years. This is considered “first use”, after which the product may be replaced, given away, or discarded¹².

A review of the 316 portable fan-related incidents showed that 150 of the involved fans were less than 10 years old, 61 fans were 10 years or older, and no age related information was available for the fans involved in the remaining 105 incidents (Table 4). Further review of these 316 incidents indicated that just over half of the involved fans had been purchased new or had been considered as “first use”.

Table 4
Distribution of Portable Fans
Classified by Fan Type and Fan Age
January 1, 1990-December 31, 2003

Portable Fan	Fan Age				
	< 1 yr.	1yr.≤Age<5 yrs.	5yrs.≤Age<10 yrs.	≥10 yrs. ¹³	Unknown
Box Fan	19	14	6	17	26
Pedestal/Floor Fan	11	22	4	16	14
Desk/Table Fan	11	21	12	6	14
Window Fan	1	2	1	11	9
Dual Window Fan	6	7	0	1	4
Window Box Fan	0	2	1	3	6
Clip-On Fan	2	2	1	1	4
Antique Small Fan	0	0	0	1	0
Hassock Fan	0	0	0	1	0
Airbed Fan	0	1	0	0	0
Tower Fan	0	1	0	0	0
Portable Fan (Not Specified)	1	2	0	4	16
Electric Fan (Not Specified)	0	0	0	0	11
Electrical Product	0	0	0	0	1
Total	51	74	25	61	105

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

¹² Karels, Terrance R., CPSC, Directorate for Economic Analysis, “Electric Fans”, Memorandum to Anna L. Luo, November 29, 2000.

¹³ Includes older type fans or very old fans.

Fan Material

In general, the contributing factor to the portable fan-related fire or potential fire was the presence of plastic materials. When a fan with plastic blades, motor housing, or enclosure overheats or catches on fire, the plastic usually melts, and drips onto combustible materials such as carpet, clothing, bedding, paper, etc. Table 5 shows that of the 295 fires or potential fires, 218 of the incidents (i.e. nearly 3 out of every 4 incidents) involved a fan with some plastic parts.

Table 5
Distribution of Hazards Associated with Portable Fans
Classified by Fan Material
January 1, 1990 – December 31, 2003

Hazard	Fan Material				
	Total	Plastic & Metal	Plastic ¹⁴	Metal ¹⁵	Unknown
Fire	266	141	53	22	50
Potential Fire	29	8	16	2	3
Electrocution	15	2	2	9	2
Electrical Shock	4	1	0	3	0
Electrical Hazard	2	1	1	0	0
Total	316	153	72	36	55

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

Manufacturers and UL Listed¹⁶

The Association of Home Appliance Manufacturers (AHAM) states that six member firms account for 75 percent or more of sales of portable fans in the U.S. market. These firms produce portable fans under a variety of brands¹⁷. AHAM reports that the major U.S. manufacturers also produce portable fans in overseas facilities, or purchase fans produced by overseas firms. According to AHAM, imported portable fans represent more than 75 percent of all portable fans sold in the U.S., and China is the major exporting country of these products¹⁸.

Loss of information on the characteristics of the fans or cords occurred most often when the fans or cords were completely destroyed in the fire or discarded by the fire departments or the owners. The manufacturer or the brand of the involved fans could be identified in only 143 incidents. Information concerning safety standards on the fans, cords, or plugs was also very

¹⁴ There were 3 fires, 4 potential fires, and 1 electrocution involving fans with some plastic parts; no information was available for the other parts.

¹⁵ There were 4 fires, and 3 electrocutions involving fans with some metal parts; no information was available for the other parts.

¹⁶ UL Standard for Safety for Electric Fans, UL 507.

¹⁷ The market distribution of these brands is not available according to the Directorate for Economic Analysis.

¹⁸ Karels, Terrance R., CPSC, Directorate for Economic Analysis, "Electric Fans", Memorandum to Anna L. Luo, November 29, 2000.

limited. For example, either the fan or the cord was identified as UL listed in only 79 incidents. Fifty seven of the involved fans were identified as being equipped with a 2-prong plug, 53 were equipped with a 2-prong polarized plug, and 18 were with a 3-prong grounded plug.

Information concerning the incident scenario such as the dwelling type, the presence or absence of safety devices (smoke or fire alarms, heat detectors, or water sprinklers), the room where the incident occurred, the fan placement¹⁹ at the time of the incident, and any problems with the fan prior to the incident is summarized in the following tables.

Dwellings

Table 6
Distribution of Dwellings
January 1, 1990 – December 31, 2003

Dwelling Type	Number of Incidents
Single Family Home	178
Apartment, Duplex, Townhouse, Condominium	73
Mobile Home/Motor Home	26
Place of Business	24
Boat, Dormitory, or Low-Income Housing	5
Barn	1
Not Stated	9
Total	316

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

Safety Fire Devices (in the Dwellings)

Table 7
Distribution of Fire Safety Devices
January 1, 1990 – December 31, 2003

Safety Device	Number of Incidents
No Smoke Detectors/Alarms/Sprinklers or Not Operating Detectors/Alarms/Sprinklers	91
Operating Smoke Detectors/Fire Alarms/Sprinklers	80
Unknown if Detectors/Alarms/Sprinklers Worked	26
Not Stated or Not Applicable ²⁰	119
Total	316

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

¹⁹ On the floor, on top of furniture, on a bed, or in a window.

²⁰ Safety system is considered not applicable in cases of potential fire, electrocution, electrical shock or hazard.

Rooms of Incidents

Table 8
Distribution of Rooms of Incidents
January 1, 1990 – December 31, 2003

Room	Number of Incidents
Bedroom	167
Living Room or Family Room	51
Office	23
Kitchen	15
Basement	8
Attic (living areas)	5
Dining Room	4
Bathroom	4
Hallway	2
Other (computer room, porch, deck, garage, barn stall, etc.)	21
Not Stated	16
Total	316

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

Fan Placement

Location of the fan played a significant part in the fire incidents. An overheated fan on top of a carpeted floor or on a pile of papers/clothing could ignite these combustible objects. If a fan is mounted in a window or on a window sill with curtains or a window blind, the curtains or blinds could jam the fan blades causing the motor to stall. Placing an unstable fan on a table/desk or clipped to a desk or to a foot board of a bed could cause the fan to fall face down and stop the oscillating function of the fan. The distribution of the incidents by placement of the involved fans is presented in Table 9.

Table 9
Distribution of Fan Placements
January 1, 1990 – December 31, 2003

Placement	Number of Incidents
On Vinyl Floor, Floor (Not Specified)	68
In the Window or Window Sill	64
On Carpeted Floor	61
On Top of Piles of Papers/Clothing	40
On Top of Table/Desk/Chair/Dresser	34
Clipped on Desk/Bed, Suspended from Ceiling	15
Other (on Ground/Counter/Washer/Dryer)	4
Not Stated	30
Total	316

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

Previous Problems

Table 10
Distribution of Previous Problems
January 1, 1990 – December 31, 2003

Previous Problem	Number of Incidents
No Previous Problems	125
Trouble Getting Fan Blade Moving	17
Cord/Plug/Switch Not Properly Functioning	16
Emitting Odor/Smoke/Flames/Humming Noise	13
Fan Had Been Repaired	8
Short Circuit / Squeaking Noise When Oscillating	3
Mild Shock	1
Problems (not specified)	5
Not Stated	128
Total	316

Source: U.S. Consumer Product Safety Commission (CPSC), Death Certificate and Injury and Potential Injury Incident Files, Directorate for Epidemiology, Hazard Analysis Division.

Conclusion

An estimated 4,500 of the residential structure fires attended by fire departments from 1990 through 1998 were associated with portable electric fans. These fires resulted in about 270 civilian injuries, more than 20 deaths, and about \$55 million in property loss. Based on 316 follow-up investigations of portable fan-related incidents occurring between January 1990 and December 2003, fire was the major hazard and accounted for over 80 percent of the total incidents. Over half of the fire incidents occurred in a single-family home and most often in a bedroom. Box fans, desk/table fans, and pedestal/floor fans were the most frequently involved fan types. A common scenario was an overheated fan on top of a carpeted floor or close to window curtains that ignited the combustible object, especially for fans with plastic material where the plastic melted and dripped on the object.

The failure modes associated with the portable fan-related hazards were the fan motors, appliance power cords, or switches. The motors failed when they overheated (because the blades jammed or the motors seized up) or when there were problems with the wiring and the fans shorted out. The fan cords failed when a cord had a short circuit or an insulation breakdown; when the cords were crushed, damaged, exposed, repaired, or attached to a faulty extension cord; or the oscillating motion caused a sharp edge on the fan to rub off the cord insulation. The switches failed due to an electrical fault in the switch or due to damaged wire.