



**SUCCESSFUL RESIDENTIAL  
SPRINKLER ACTIVATION**

Cobb County, GA  
May 2, 1985



**FIRE  
INVESTIGATIONS**

NATIONAL FIRE PROTECTION ASSOCIATION

1 Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101 USA  
Telephone: 1-617-984-7263      E-mail: [investigations@nfpa.org](mailto:investigations@nfpa.org)

Summary Investigation Report  
Successful Residential Sprinkler Activation  
Cobb County, Georgia  
May 2, 1985  
1 Child, 3 Adults Saved

Prepared by

Michael S. Isner  
Fire Protection Specialist

In Cooperation with

Federal Emergency Management Agency/  
United States Fire Administration

and

National Bureau of Standards/  
Center for Fire Research

This investigation was conducted by the National Fire Protection Association (NFPA) under an agreement with the Federal Emergency Management Agency/United States Fire Administration (FEMA/USFA) and the National Bureau of Standards/Center for Fire Research (NBS/CFR). The investigation was jointly funded by these agencies and the NFPA.

The substance of this investigation report is dedicated to the public. It may be freely reprinted with the customary crediting of the source. The author and publisher are solely responsible for the accuracy of statements or interpretations contained herein.

## ABSTRACT

Since their first installation in 1982, Cobb County sprinkler systems have successfully controlled a number of fires in residential properties. In each case the fires did not cause injuries and fire officials reported property damage was minimal. The most dramatic of these incidents occurred on May 2, 1985 when a fire started in a toddler's bedroom. During the incident, a circuit breaker tripped cutting power to the apartment's only smoke detector, and the sleeping occupants did not receive early warning. Still, a residential sprinkler extinguished the fire, alerted occupants, and allowed safe evacuation of the building.

The result of this incident differs sharply from the results of many other similar residential fires in which tragic losses of life have occurred. One such incident happened in Hollywood, Florida on the night of December 20, 1982. The lack of early occupant warning and extinguishment of the fire in its incipient phase resulted in the death of a child.

A comparative analysis of the Cobb County and Hollywood incidents demonstrates the life safety benefits of residential sprinklers. It also suggests that residential sprinklers will be able to maintain a tenable environment for occupants in residential fire scenarios that, in the past, had resulted in tragic losses of life.

## INTRODUCTION

The National Fire Protection Association (NFPA) investigated the Cobb County, Georgia incident in order to document significant factors relative to the successful residential sprinkler operation.

This study was conducted under a major fires investigation agreement between the Federal Emergency Management Agency/United States Fire Administration (FEMA/USFA), the National Bureau of Standards/Center for Fire Research (NBS/CFR), and the NFPA. The agreement, funded by FEMA/USFA, NBS/CFR and the NFPA, provides for the investigation of technically significant fires by the NFPA's Fire Investigations and Applied Research Division to document and analyze incident details and report "lessons learned" data for loss prevention purposes.

The NFPA became aware of the fire on the day of occurrence, May 2, 1985. Michael S. Isner, Fire Protection Specialist, NFPA Fire Investigations and Applied Research Division, traveled to Cobb County, Georgia for a 3-day, on-site study to document facts regarding this incident. In addition, a search of Fire Incident Data Organization (FIDO) records was performed to locate a comparable incident in which a sprinkler system was not present. These activities and subsequent analysis are the basis for this report. Data collection activities were made possible through the cooperation of the Cobb County, Georgia and the Hollywood, Florida Fire Departments. This report presents the findings of the NFPA data collection and analysis effort.

This report is another of NFPA's studies of fires having particular educational and technical interest. The information presented is based on the best data available during the on-site collection phase and during the development of this report. It is not NFPA's intention that this report pass judgment on, or fix liability for, casualties or property loss in these incidents.

The cooperation and assistance of Chief David Hilton, Lieutenant Jerry Grier, Residential Sprinkler Division and Fire Fighter Darell Cobb, Residential Sprinkler Division, Cobb County Fire Department, is acknowledged and appreciated.

In addition, the cooperation and assistance of Mr. Loran L. Cochran, Fire Investigator in the Bureau of Fire Prevention of the Hollywood, Florida Fire Department is also acknowledged and appreciated.

## BACKGROUND

Historically, NFPA statistics indicate that the majority of fire deaths occur in residential occupancies. In 1983, civilian fire death estimates indicated that roughly 80 percent of the nearly 6,000 persons killed by fire were killed in residential fires -- dwellings, apartments, mobile homes, hotels and motels.<sup>1</sup> Fully 65 percent were killed in dwellings.

Since a large number of deaths in dwellings occur while the victim is asleep,<sup>2</sup> early warning devices were developed to provide occupant protection and reduce these losses. Smoke detectors for residential application were introduced decades ago and began to be widely installed in homes in the 1970's. Current estimates indicate that smoke detectors are in approximately 75 percent of the nation's homes. A forthcoming NFPA report in Fire Journal states that "a person who has a home fire and does not have a detector is twice as likely to die in that fire as another person who suffers the same fire but is protected by detectors."<sup>3</sup> Recently, research and development in automatic sprinkler protection have produced a system that will have the potential for also reducing life losses in dwellings. Knowing the history of sprinkler successes in commercial applications, the NFPA, federal agencies, and private organizations began to combine their efforts in order to apply this technology for use in residential occupancies. One of the first efforts in this area came from the NFPA Committee on Automatic Sprinklers that developed and approved the first (1975) edition of NFPA 13D, Standard for the

---

<sup>1</sup>Michael J. Karter, Jr., "Fire Loss in the United States During 1983," Fire Journal, September 1984, p.48.

<sup>2</sup>Gordon P. McKinnon, Editor-in-Chief, Fire Protection Handbook 15th Edition, 1981, p.2-23.

<sup>3</sup>J.R. Hall, "A Decade of Detectors: Measuring the Effect," forthcoming in Fire Journal.

Installation of Sprinkler Systems in One- and Two-Family Dwellings and Mobile Homes.

After this major development and recognizing that a residential sprinkler system must also be cost-effective in order to gain wide acceptance and use, the Federal Emergency Management Agency/United States Fire Administration (FEMA/USFA) funded a series of research efforts to develop a low-cost residential sprinkler system. Eventually, researchers determined that the sprinkler for a residential system needed to have uniform discharge density and quick response capabilities in order to provide life safety in the room of fire origin. In step with these test results, NFPA 13D was revised in 1980 to require listed residential sprinklers.

Many communities became interested and involved in the program as information about the new sprinkler technology was released. One such community was Cobb County, Georgia. Early in the 1980s, Cobb County was experiencing an explosive growth in both commercial and residential building construction. Cobb County Fire Department Officials, concerned about their ability to provide adequate fire protection within their budgetary constraints, began to look for alternatives. Fire Chief Hilton and his department concluded that the installation of residential sprinkler systems could help reduce their need for residential fire protection.<sup>4</sup> Subsequently, they launched an effort to protect new multifamily dwellings<sup>5</sup> with residential sprinklers which they refer to as their "Instant Firefighter."

---

<sup>4</sup>J.F. Riseden, "Cobb County, Georgia: Is Their 'Life Safety System' Leading the Way?" Sprinkler Quarterly, National Fire Sprinkler Association, Fall 1983, No. 47.

<sup>5</sup>To date, no edition of NFPA 13D (1975, 1980, or 1984 -- the most current stipulated edition) has the application of 13D sprinkler technology to residential occupancies other than one- and two-family dwellings and mobile homes, i.e., multifamily dwellings, boarding homes, rooming houses, etc. Cobb County Fire Officials (the Authority Having Jurisdiction) approved the use of NFPA 13D-type systems in multifamily dwellings and other occupancies.



About one year after the first Cobb County sprinkler system was installed, citizens began to benefit from the fire department's efforts. One afternoon in September 1983, a woman preparing popcorn inadvertently applied too much heat to the grease and it flashed into flame. The sprinkler activated and extinguished the fire. That same year in December, a reportedly intoxicated man turned on his electric stove and then fell asleep. A pan with grease was sitting on the stove and became involved in fire. At some time into the incident, the smoke detector in the room operated but the individual did not respond. As the fire developed, the sprinkler fused, discharged water, and extinguished the fire. The occupant escaped unharmed. In September 1984, a barbeque grill on an apartment patio caught fire. When the fire burned through a wall in to the utility room, the room's sprinkler activated. Both the fire in the room and the fire involving the grill were controlled by the sprinkler.

A notable illustration of the benefits of residential sprinklers occurred on May 2, 1985. An early morning fire in a young girl's bedroom activated the room's sprinkler thereby possibly preventing the child's death. In addition, the activation controlled the fire before it could compromise the safety of three sleeping adults who were in other rooms of the apartment.

#### Successful Residential Sprinkler Operation

Lakemont Drive, Symera  
Cobb County, Georgia  
May 2, 1985

#### The Building

The home, constructed in 1982, was a wood frame structure located on a sloping site. Two "townhouse" apartments shared a common front entrance on grade level (see Photo 1). A third apartment, the area of fire origin, was located in the basement. The apartment's entrance was on the side of the building; because of the sloping site, this entrance was also at grade level.

Sections of the basement apartment's exterior walls were made of concrete block since they served as part of the building's foundation (see Figure 1). The remaining exterior wall sections were wood frame and consisted of metal exterior siding, wood sheathing, 2-by-4-inch studs, fiberglass insulation, and 1/2-inch gypsum wall board.

The basement apartment had a relatively standard floor plan consisting of a living space connected to sleeping areas by a central corridor, as shown in Figure 1. Each living space had an exterior opening except Bedroom A, which did not have a window.

Interior partitions were gypsum wall board on 2-by-4-inch wood studs and the ceilings were gypsum wall board on 2-by-8-inch wood floor joists. Neither the partitions nor the floor/ceiling assembly contained thermal insulating materials. All interior surfaces were painted; ceiling trim, baseboards, and door casings were wood. Interior doors were also wood and non-fire rated. The floor was a concrete slab on grade.

Fire loading in Bedroom A, the room of fire origin, was moderate. A small picture and a 3-by-4-foot piece of cloth material were the only noted combustible materials attached to the painted walls. The room's bed consisted of a full-size mattress and box springs supported by a standard metal bed frame. The bed had no foot or head board. A bed spread, blanket, two sheets, and a pillow comprised the remainder of the bedding material. A bean-bag type chair was positioned against a four-drawer wood chest and a wood chair with two upholstered pads. These items were about one foot from the bed. A portable electric fan with a square metal frame, plastic grills, and plastic blades was approximately two inches from a wall. Within two or three feet of this fan were several large plastic toys. One of these toys, a plastic riding horse, was about halfway between the fan and the bean-bag chair.

## Fire Protection

The building was equipped with a residential sprinkler system which basically complied with NFPA 13D 1980 requirements for water flow and sprinkler spacing. The system, which was one of the first systems constructed in Cobb County, was installed during construction of the building. Taking water from the domestic water supply through a 1-inch meter, the single riser fed sprinklers in all three apartments. The sprinkler piping (polybutylene with fused connections) was arranged in a standard "tree" configuration. Branch lines (3/4-inch diameter) were restricted to 25 feet or less and the cross main (1-inch diameter) ended with a connection to the commode. Cobb County Fire Officials refer to this type of system as a "Circulating System."<sup>6</sup>

The Cobb County building code permits the use of a circulating system in low water pressure areas. This type of system must meet minimum water flow and pressure requirements; however, it is not equipped with a "backflow preventor" because these devices create large pressure losses. In lieu of the preventor, the system's terminal end is connected to a regularly used water closet or other appliance. Use of the appliance prevents water stagnation in the sprinkler system.

Fire officials reported that sprinklers were installed according to the Cobb County building code. The code states sprinklers are not required in bathrooms and closets less than 25 square foot, foyers, halls or attics. The code also requires that all other areas including unprotected drive-in garages and basements (finished and unfinished) be sprinklered.

---

<sup>6</sup>No edition of NFPA 13D has addressed the use of this type of sprinkler system; however, Cobb County Fire Officials (the Authority Having Jurisdiction) approved its use.

Room sizes throughout the building were such that two sprinklers provided adequate coverage. As a result, the system was designed and tested for a two-sprinkler flow condition.<sup>7</sup> During the acceptance test, the most remote two sprinklers were operated independently and both sprinklers gave the same results -- 20 gpm at 55 psi (residual). When they were operated together, the total flow was 28 gpm at 25 psi (residual). Static pressure for the system was listed at 98 psi. Listed residential sprinklers rated at 135<sup>0</sup> were used throughout the building; the only exception to this was the 165<sup>0</sup> standard sprinkler installed in the furnace room. All were pendent sprinklers.

In addition to the sprinkler system, a smoke detector had been installed outside the bedrooms in the corridor of the basement apartment. The detector was A/C powered.

#### The Fire

On May 2, 1985, an early morning thunderstorm passed through Cobb County. On that morning, three adults and one toddler occupied the basement apartment, and the two upper level apartments were occupied. The toddler was in Bedroom A, two of the adults were in the back bedroom (Bedroom B), and one adult was sleeping on the living room couch. Doors to all bedrooms, bathroom, and closets were closed.

The child's mother was awakened by cries from the toddler, she left her room to determine the problem and saw an indication of fire in the child's room. Recognizing the danger, she screamed and her companion came from Bedroom B. They swung open the bedroom door and found the sprinkler

---

<sup>7</sup>In addition, Cobb County Fire Officials require that all residential sprinkler systems that protect rooms containing three or more sprinklers be designed for simultaneous operation of all heads in the room, up to a maximum of 4 sprinklers. The officials also require that residential sprinkler systems, except those in single-family dwellings containing fewer than 20 sprinklers (even when voluntarily installed by the owner/occupant), have a 1 1/2-inch fire department connection. These requirements exceed those of NFPA 13D - 1980.

operating. Smoke had accumulated in the room; however, the room's atmosphere was still tenable at the child's breathing level. The adults moved past the nearly extinguished fire, grabbed the crying child, and exited the room leaving the bedroom door in the open position.

About the time that the two adults entered the child's room, the third adult called the fire department. Receiving the call at 6:23 a.m., the fire department dispatched a normal response to a building fire: 2 engines, a truck, and a battalion chief.

When the fire department arrived at 6:28 a.m., all occupants were out of the building and the sprinkler system was still flowing water. Fire fighters were met by some smoke in the apartment but found that the sprinkler system had controlled the fire and extinguished all flames. Their efforts then switched to locating any hot spots and performing salvage to reduce water and smoke damage. Since all ladder trucks in Cobb County carry a sprinkler system servicing kit, fire fighters were able to replace the activated sprinkler and return the sprinkler system to full operation before they left the scene.

#### Casualties and Damage

None of the adults was physically harmed by smoke, heat, or flame. Even the toddler, who was in the room of fire origin, was removed from the fire scene without injuries.

The fan was severely damaged (see Photo 2). The grill facing the wall was completely consumed, whereas the grill facing the room was only partially consumed. The motor, all metal horizontal crossmembers, and the base of the fan also showed severe scorch marks. Molten plastic fell on both sides of the fan and burned. The burning plastic began to involve small areas of rug, adjacent to the fan. In addition, the wood baseboard directly behind the fan and approximately two feet of door molding was burned and charred. The fire left a distinct burn pattern on the wall about 12 inches wide at floor level

and tapering up toward its apex about 24 inches above the floor. The fire also left a small burn pattern, approximately 6 inches by 6 inches on the door.

Soot lightly coated the walls, rug and furniture in the child's room. Since the door was left open, this residue extended to the corridor walls and rug immediately outside of the bedroom.

Water from the sprinkler affected only surfaces in the room of fire origin. A wetted area revealed the ceiling section that water directly contacted. This radiated out from the sprinkler and was approximately six feet in diameter along the largest axis. Water stains on the walls clearly showed the heights that water reached. In most areas, the water was within inches of the ceiling (see Photo 3).

#### Analysis

Cobb County fire officials determined that a power surge due to a lightning strike caused a failure in the fan's electric motor which eventually started the fire. Sometime during the ignition sequence, the circuit breaker that monitored the fan tripped. Fire investigators also determined that the apartment's only smoke detector was on the same circuit as the fan so power to the detector was interrupted when the circuit breaker tripped. Since the smoke detector was rendered inoperative, it would not have provided warning to permit rescue of the child.

Once ignited, the fire apparently spread from the motor to various plastic components which melted and burned. Much of the burning plastic fell to the floor, accumulated on the rug and began to transfer fire to the floor area. The completely consumed grill which was near the wall, the extent of rug damage, and scorch marks on both the wall and the fan indicate that fire between the fan and the wall was more intense than the fire on the side of the fan that faced the room.

This difference in fire intensity may have been due to fire being initially shielded from the sprinkler's water spray by the fan, the fire's proximity to the wall, or a combination of both. Apparently, radiation feedback between the wall and fan also contributed to fire growth. Researchers have confirmed, and now consider in their calculations, the fact that fire growth near walls is more rapid than fire growth in open areas.<sup>8</sup> Since the fan was very close to the adjacent wall, fire between the two probably was affected by this phenomena.

Burn marks on the wall and fan also showed that flames had reached an approximate height of two feet. The fire also produced quantities of smoke sufficient to leave some soot in the room of origin and in some adjacent areas. This evidence, plus the amount of unburned debris near the fan, suggest that the fire was well established at the time of sprinkler activation and had the potential for spreading to other areas in the room.

Eventually, the fire produced enough hot gases to cause the sprinkler to fuse. Discharging water awakened the child; she began to cry which alerted her mother to a problem. The sprinkler operated before lethal quantities of combustion by-products reached the breathing level of the child. In addition, it quickly reduced the fire's size and permitted the adults to pass the burning fan in order to rescue the child.

The result of this incident might have been drastically different had the sprinkler system not been present. Since the fire involving the fan had the potential for spreading, its radiated heat would likely have involved the plastic toys adjacent to the fan. When this occurred, the fire would then have easily reached the room's largest fuel package consisting of the bean-bag

---

<sup>8</sup>R. L. Alpert and E. J. Ward. Evaluating Unsprinklered Fire Hazards. SFPE Technology Report 83-2. Society of Fire Protection Engineers, May 1983.

chair, wood chair and chest. Since the toddler's room was relatively small (10 feet 10 inches by 9 feet 6 inches by 8 feet), an uncontrolled fire would have quickly grown to the point of room flashover, a condition in which survival is considered impossible.<sup>9</sup>

The burning fan's position near the bedroom's only means of escape contributed to the potential for entrapment. Flames easily could have prevented the child or an occupant of any age from exiting through the door. Since Bedroom A did not have a window, the occupant could have been trapped.

Aside from presenting an actual and severe threat to the child's life, the fire, if unchecked by the sprinkler, also would have compromised the safety of the adults within the apartment. The occupants of Bedroom B would have had to pass by the child's room in order to use either of the apartment's two exit doors. Heat, smoke, and flames resulting from an uncontrolled fire in the child's room could have prevented passage to the exit doors. Thus, the adults in Bedroom B, if still able to react, would have been forced to escape via their bedroom window.

Understanding the potential for tragedy in this incident, Chief Hilton of the Cobb County Fire Department stated that the sprinkler system activation unequivocally saved the child's life. He also credited the system with saving the lives of the three adults in the apartment and with preventing the potential injury or death of the first floor apartment's occupants.

The analysis of this incident confirms Chief Hilton's statement.

---

<sup>9</sup>E. C. Butcher and A. C. Parnell, Designing for Fire Safety, John Wiley and Sons, New York, 1983.



## Fatal Fire -- No Residential Sprinklers<sup>10</sup>

Hollywood, Florida  
December 20, 1982

### The Building

This single-story masonry and wood apartment building contained eight small apartments housing low-income families. It formed a "C" shape and had three distinct sections separated by two breezeways. The top leg contained apartments 1, 2, and 3; the middle section was formed by apartments 4 and 5; and the bottom leg contained the remaining three apartments. A single wood-truss roof covered the entire building. The external bearing walls were concrete block with a stucco finish and internal non-bearing walls were gypsum board on wood studs. The non-fire rated doors were wood.

The fire occurred in Apartment 1. This apartment contained a small space that served as the living room/dining/kitchen area. Two doors provided direct access from the living room to the outside. In addition, two other doors opened into the two bedrooms.

The child's bedroom, the room of fire origin, was a 9-by-10-foot room with 8-foot ceilings. Two of its walls were masonry exterior walls; each contained one jalousie window. The floor was a concrete slab and the ceiling was gypsum board nailed directly to the wood roof trusses.

The small apartment had little storage space, so some of the living space was used for storage of combustible materials. This practice resulted in a higher than normal fire load for the residential occupancy.

---

<sup>10</sup>This fatal incident was selected from the NFPA Fire Information Data Organization (FIDO) data base for comparison purposes. This incident illustrates a fire scenario similar to the Cobb County incident; however, no residential sprinkler was present and the occupant in the room of fire origin died.

## Fire Protection

The apartment was not equipped with a sprinkler system. The only smoke detector in the apartment was a single station battery powered unit and the battery had been removed.

## The Fire

On the evening of December 20, 1982, a couple put their 2-year-old daughter to bed and turned on an old electric space heater in order to help keep her warm. Closing the door, they left the child's room, went to their room and retired for the night.

About 1 1/2 hours later, the father woke up and realized that there was a fire in the child's room. He attempted to rescue her but was driven back by the smoke and heat. The rapidly growing fire forced him and his wife to leave the apartment. Once outside, the father went to get assistance. Soon after, a passerby attempted to rescue the child, but he too was driven back by smoke and heat.

The local fire department received a call, from an unknown source, reporting the apartment fire with a trapped child. Immediately two engines, a snorkel, and a rescue vehicle were dispatched; the time was 2224. Arriving fire units (time 2228) found heavy smoke and a self-venting fire coming out of both windows in the child's room. In an effort to rescue the child, a handline was placed into one of the windows and fire fighters attempted to enter the apartment through one of the doors. Only after the fire in the child's room was knocked down, and the room cooled, could the fire fighters enter the room to execute their search.

## Casualties and Damage

The child's badly burned body was found lying face down among the remains of the metal bed frame. The coroner's report listed the cause of the child's death as asphyxiation.

Before the fire fighters extinguished the fire, it completely consumed all the combustible materials in the child's room. It also burned through the bedroom's ceiling allowing the fire to spread into the attic space. Roof trusses above the apartment received severe fire damage. The fire also burned through the door to the child's bedroom and spread into the living room. Smoke traveled throughout the entire building via the attic space and caused damage to most apartments. Smoke conditions were so severe in Apartment 3 that a dog was also asphyxiated.

### Analysis

As noted in the incident report, Hollywood Fire Officials determined the cause of the fire to be accidental. They felt the most probable ignition scenario was radiant heat from the space heater igniting bedding. However, the investigators did not rule out the possibility of the radiant heater having ignited other combustible materials or a malfunction of the heating unit.

Once ignited, the fire grew rapidly on the abundant combustible materials present in the room. With the masonry walls, a concrete floor slab, and limited ventilation controlling the rate of heat loss, the potential for full room involvement quickly developed in the small room. Flashover apparently occurred sometime before the fire department's arrival; fire fighters found the child's room fully involved, flames coming from its windows, and fire extending into other compartments.

Since the smoke detector was not operational and residential sprinklers had not been installed, the adults were not alerted and slept through the initial phases of the fire. Gradually, smoke and gases, a threat to the safety of the adults, began to spread from the child's room and accumulate in other areas of the apartment. For some unknown reason, the male adult awoke, became aware of the fire, and eventually escaped with his wife. Unfortunately

the fire in the child's room had grown to such a magnitude that it thwarted all attempts to rescue the child.

Had a detector been present and operated, the adults would have become aware of the fire earlier increasing their time for escape. However, the presence and operation of a detector might not have improved the potential for the child's escape or rescue. A smoke detector's ability to provide early warning would have been limited because the child was in the room of fire origin and the detector was outside of that room. It's capability for early warning would have been reduced even further since the door to the room was closed in this incident.<sup>11</sup>

Had the building been protected with residential sprinklers, a single sprinkler in the room of origin could have saved the child's life. The fire investigator stated that radiant heat from an electric heater probably ignited bedding materials. This suggests that the fire may have initially started as a small smoldering fire and then grew to an open burning fire. The room's small size, thermal characteristics and lack of ventilation would have permitted the hot fire and gases to collect at ceiling level. These gases would have eventually activated the sprinkler. Factory Mutual tests with residential sprinklers in small non-ventilated rooms reveal that a residential sprinkler will control a fire before untenable conditions are reached at eye level in the room.<sup>12</sup> Similarities between conditions and fire

---

<sup>11</sup>Section 2.2 of Appendix B to NFPA 74, Household Fire Warning Equipment 1984 states that "The location of required smoke detectors does not provide adequate protection for the occupants from a fire starting within their bedrooms, nor do the required smoke detectors provide reliable early warning protection for those areas separated by a door from the areas protected by the required smoke detectors. For this reason, it is recommended that the house holder consider the use of additional smoke detectors..."

<sup>12</sup>R. P. Fleming, "Understanding the New Sprinklers," Sprinkler Quarterly, National Fire Sprinkler Association, Fall 1983, No. 47.

characteristics in this incident and those of the Factory Mutual tests, suggest that the sprinkler would have activated controlling the fire and the sprinkler could have saved the child's life.

#### Comparative Analysis of the Cobb County and the Hollywood Incidents

Flashover in a room is considered to be a condition during fire growth when there is little, if any, occupant survival potential, even though untenable conditions may exist prior to its occurrence. Therefore, occupant survival potential in the incidents just discussed may be compared by evaluating those factors which affect flashover. These details from each incident have been presented in Table 1.

Conditions that can affect pre-flashover fire growth dynamics appear in the "Room of Origin" section. Examination of the table reveals that many similarities exist between the rooms of origin in each incident. For example, both rooms of origin were small, similar in shape, and almost identical in size. In addition, both rooms had framed walls, masonry walls, similar ceiling construction, and concrete slab floors; therefore, their heat loss through boundaries (another factor affecting flashover potential) would be similar. With the doors and windows closed in both rooms, ventilation was poor; also, the types of combustible materials were similar. Since room geometry, heat transfer characteristics, degree of ventilation, and type of available fuel were similar, the potential for flashover in both rooms also would have been similar.

Table 1 also lists many details that were different between the two fire scenarios. Most differences, however, would have had little or no effect on the two children's ability to survive. For example, one room did not have any windows, whereas the other room had two. In both cases, however, the

occupants were "too young to act;" therefore, they would not have been capable of exiting through a window. Even though plastic material which produce large quantities of smoke were burning, the sprinkler in the Cobb County apartment maintained a tenable environment. Since the smoldering bed clothing in the Hollywood incident was believed to be the result of radiant heat exposure, the amount of smoke and heat would have increased as the exposure to radiant heat continued. Hot gases accumulating at ceiling level would have also caused a sprinkler to activate and maintain a tenable environment. Fire loading in the Cobb County room was less than that in the Hollywood room. The increased fuel load may have slightly increased flashover potential, but its most notable effect would have been increased fire severity and duration after flashover occurred. In the Hollywood incident, both the body's position and the coroner's report indicate that the child died prior to flashover. Therefore, post-flashover fire severity had no impact on the child's death.

The major difference between the two fire scenarios that can account for the survival of the child in Cobb County and the death of the child in Hollywood is the presence of the residential sprinkler system. In Cobb County, the sprinkler sensed heat from the burning fan and began to discharge water. Since the system provided the required water flow and pressure, the sprinkler developed an effective discharge pattern which controlled the fire before combustion by-products threatened the child. Based on the earlier discussion, it is likely that a residential sprinkler would have activated and saved the life of the child in Hollywood, Florida.

#### Discussion

The fire scenario described in the Cobb County and the Hollywood incidents -- namely, sleeping individuals who are "too young to act" and in

the room of fire origin -- is one of the most challenging scenarios for providing protection of life. In addition to needing early warning, such occupants may also need to be aided during their escape from the fire.

The analysis of the Cobb County incident clearly indicates that the residential sprinkler effectively protected the toddler's life. Similarly, the analysis of the Hollywood incident indicates that a sprinkler system could have also saved the life of the child in that tragic fire.

Because the analysis addressed only two similar scenarios, one can not conclude that residential sprinklers will be effective in all other fatal residential fire scenarios. Further, some less severe scenarios may be effectively mitigated by much less expensive detection systems and other scenarios may be beyond the capacity of both sprinklers and detectors. None the less, results of the two incidents discussed in this report do show the potential impact of residential sprinklers on a significant number of fatal residential fire scenarios that occur throughout the United States. Additional residential sprinkler activations should provide the data needed to extend the results of this preliminary analysis.

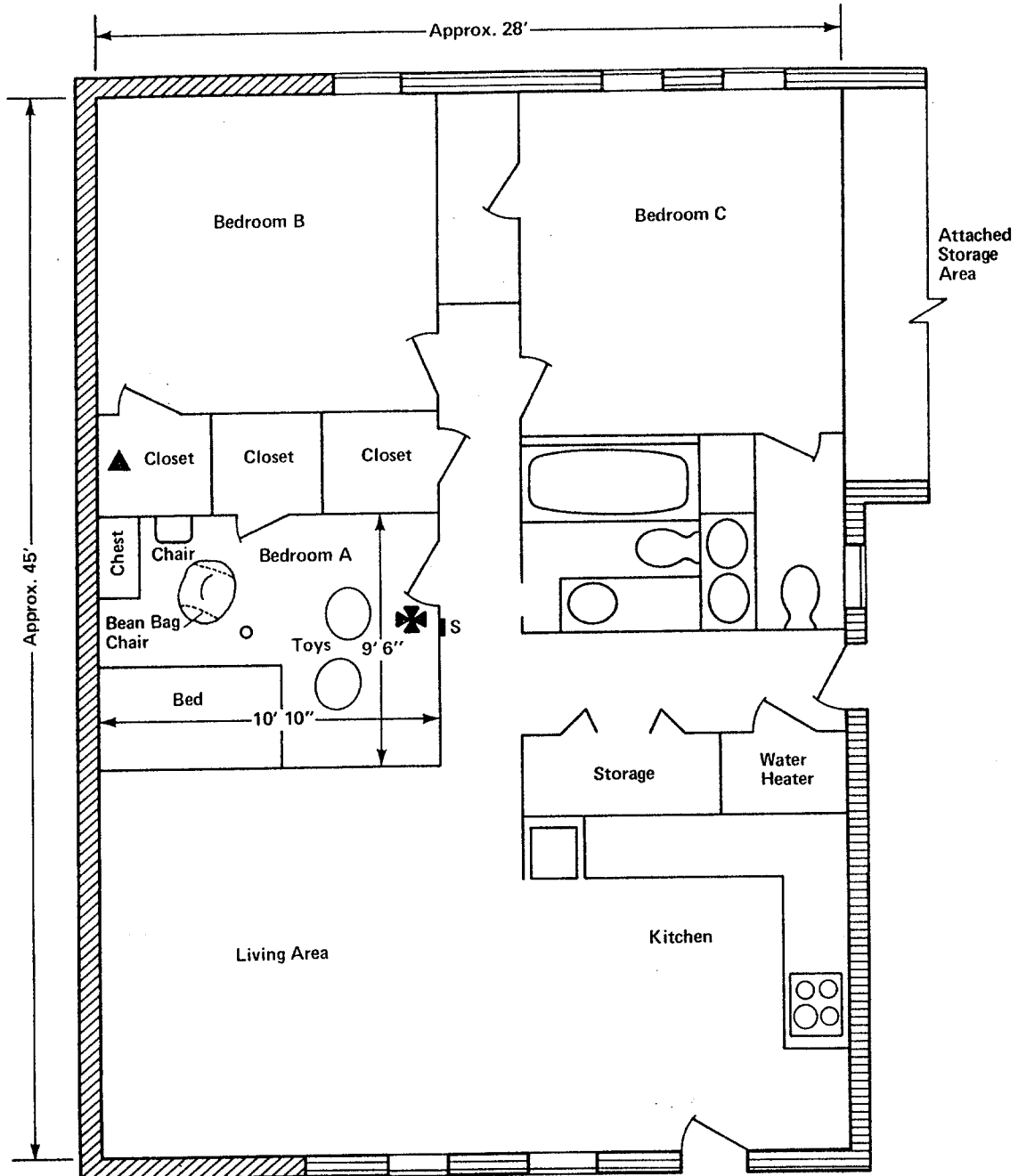
## Fire Details

### Table 1

<u>DETAIL</u>	<u>INCIDENT</u>	
	<u>Cobb County, GA</u>	<u>Hollywood, FL</u>
<u>Room of Origin</u>	Ground	Ground
* Level	Bedroom	Bedroom
* Type	10'10" x 9'6" x 8'	9'10" x 9' x 8'
* Size	Rectangle	Rectangle
* Shape	1	2
Number of masonry walls	3	1
Number of wood frame walls	Sheet rock on wood joists	Sheet rock on wood joists
* Ceiling construction	0	2
Number of windows	Yes	Yes
* Windows/doors closed during fire		
<u>Protection</u>		
<u>In Room</u>		
* Smoke detector	No	No
Sprinkler	Yes	No
<u>In Building</u>		
Smoke detector	Yes	No
Sprinkler	Yes	No
<u>Occupant</u>		
* Age	18 months	2 years
* Sex	Female	Female
* Activity before fire	Sleeping	Sleeping
* Alone in room	Yes	Yes
* Attempt to escape	No	No
* Capable of escape	No	No
* Location when found	On bed	On bed
Condition when found	Wet and frightened	Dead
<u>Fire</u>		
Time of F.D. response	0623	2224
Equipment involved in ignition	Fan motor	Electric space heater
Materials first ignited	Plastic fan parts	Bed clothing
Did fire extend from <u>area</u> of origin?	No	Yes
Did fire extend from <u>room</u> of origin?	No	Yes
Did fire involve all combustibles in room?	No	Yes
* Did <u>potential</u> for flashover exist?	Yes	Yes
Did flashover occur?	No	Yes

\*This shows items that are similar or identical in both fires.





Note: Not Drawn to Scale

- Key:
- ▲ Sprinkler Manifold (Riser)
  - | S Smoke Detector
  - Sprinkler Head
  - ✱ Origin of Fire
  - /// Concrete Block Construction
  - ==== Wood Construction