Fire! New Ways to Prevent It

The United States and Canada have by far the highest death rate in the world from fires, but new methods may reduce the fire toll by making people more aware of the problem

THE New Year's Eve fire at the Dupont Plaza Hotel in Puerto Rico is just another example, say fire experts, of a fact that seems inescapable: the United States and Canada have a serious fire problem. For at least two decades, the two countries have had the two highest fire death rates in the world.

"It's not a reporting problem," says Philip Schaenman, president of TriData, an Arlington, Virginia, fire consulting firm. "Other countries have more complete reporting systems than we do." It also is not just a small difference. The fire death rate in the United States is twice as high as the worldwide average and the death rate in this country is as much as four times the rates in some countries.

The data are striking. Each year 6,000 people die in fires in this country and 60,000 are injured seriously enough to require medical attention. Fires kill more Americans than all other natural disasters combined and cost society $30 billion each year.

The contrast with other countries is impressive. Chicago, which is half the size of Hong Kong, has three times as many fire deaths, according to Schaenman. New York City has more trips by its fire department in a year than the entire country of Japan. Baltimore, which is about the size of Amsterdam, has 13 times as many fire deaths.

So the question is why? What do other countries do that the United States does not? And the answer, say fire researchers, is more sociological than technical. "The biggest single reason is a lack of awareness in this country that there is a problem," says Schaenman. "And when fire does get attention, it is in the context of a Dupont Plaza or MGM fire, which is not the bulk of the problem." Most fires and most fire injuries occur in one- or two- family homes.

One answer to the U.S. fire problem may be to make people aware of it. But another answer, say fire researchers, may be to make greater use of technologies that are already at hand, such as a computer system to identify arson-prone buildings, and by implementing new systems that are now being developed, such as a computer simulation of how fires grow and how people behave when they are caught in a burning building.

It is not as though the United States ignores fire safety entirely. There are fire codes and sprinkler systems in many apartments and commercial buildings. And this country was quick to embrace smoke detectors. In 1975, fewer than 5% of all homes had smoke detectors. In 1985, 74% did. Smoke detectors, says Schaenman, represent "the fastest growing acceptance of a new technology in the home in U.S. history." And the United States, he continues, "is by far the most advanced country in the use of detectors. No other country comes anywhere close to our statistics." But Americans tend to assume that fires are unlikely and that if they do occur, smoke alarms and sprinkler systems will save them. They tend to be blasé about fire safety, bored with fire drills and routine fire awareness programs.

Other countries are different. Television stations in this country air fire safety spots on occasion, for example, but in other countries, such spots are aired regularly and in prime time. American schoolchildren visit firehouses, have fire drills, and are taught about fire safety. But other countries do it more often and involve their citizens to a greater degree.

Wide World

No time to escape. *Guests in the Dupont Plaza Hotel in Puerto Rico died as the casino flashed over—literally exploded with fire so that anything or anyone in the room burst into flame.*

For example, according to Schaenman, in Japan, a public relations car equipped with a loudspeaker is sent to the scene of each fire to lecture the crowd that gathers to watch the blaze. Radio and television stations broadcast 20- to 30-second fire prevention messages every few days during prime time. Twice a week, in the late morning, television stations broadcast a 5-minute fire safety program. Every 3 days, the Osaka fire department holds a press conference. The Osaka department also broadcasts live on two radio stations for 5 minutes twice a day. Women in one-third of the households in Nagasaki belong to fire prevention clubs in which they spread fire safety information to their friends and neighbors. The constant pounding of fire safety messages never lets up. "The vast majority of citizens are reached over and over again, from the time they are children through adulthood, by a variety of media and approaches," Schaenman says. In addition, there are legal penalties against gross negligence that leads to a fire. And if a person's home does catch on fire, he is ostracized and frequently finds he must move to another neighborhood to avoid the social pressure.

In Hong Kong, fire inspectors make random, surprise visits, Schaenman reports, and people are encouraged to report their neighbors' fire hazards to the fire inspectors. It also is a crime in Hong Kong to be "in a group of people using an illegal fire, whether or not it was lit by a member of the group."

In Switzerland, Germany, and Sweden, the government sends a chimney sweep from one to four times a year to inspect each homeowner's fireplace, and the homeowners must pay for this service. The Swiss chimney sweeps also provide fire safety inspections and maintain home heating systems. "The owners of Swiss chimney sweep companies are millionaires," says Schaenman. "It is a serious, skilled profession. In this country, it is hard to tell the difference between competent, highly trained sweeps and fly-by-nights." In Switzerland and in Sweden, insurance companies deter arsonists by paying in full for a fire only if the structure is rebuilt on the same spot. In France, the government insists that building

owners take some loss when there is a fire. The English and Australian governments oppose smoke detectors, says Schaenman, for fear they will make the citizens less vigilant. Like Japan, European countries, have repeated television spots on fire safety.

But American homeowners, says Jack Snell of the Center for Fire Research at the National Bureau of Standards, "would not take kindly" to the heavy-handed European and Asian approach to fire safety. Or, at least, few outside the fire prevention agencies seem terrbily interested in greatly expanding U.S. fire safety education. Yet there are some typically American ways that fires can be and are being prevented.

The National Fire Administration in Emmitsburg, Maryland, for example, helped develop an Arson Information Management System, or AIMS, which provides a profile of how arson-prone a building may be. This is the agency that is investigating the Dupont Plaza Hotel fire. "If there was a working AIMS in Puerto Rico," says Clyde Bragdon, who heads the fire administration, "the fire at the Dupont Plaza might never have occurred." The computerized system keeps track of such things as a building's owners—and changes of ownership—its occupants, and histories of such things as labor disputes and previous fires. Not only does it pinpoint buildings that are likely to be targets of arsonists but it "serves as a deterrent," says Bragdon. "People are aware that the building is being watched."

In Puerto Rico, the hotel employees would have been taught how to spot an arsonist and what to do if there were a fire. For example, there are reports that the employees tried unsuccessfully to put out the fire. It may be that what they should have done was to quickly evacate the building.

In Brooklyn, New York, a group called the People's Firehouse has used AIMS to reduce the number of fires by 64% over the past 4 years. Fred Ringler, who is executive director of the firehouse, says that his organization keeps track of such things as building code violations, ownership changes, mortgages, and tax liens to determine which buildings are likely to be torched. Then Ringler or his colleagues actually pay a personal visit to suspicious landlords. "We tell them that their building is arson-prone and that we are keeping an eye on it and that we will turn our information over to the fire marshals," Ringler says. "Once we put the landlord on notice, we reduce the possibility of arson. Also, if we can identify the insurance company, we sometimes contact the insurer."

Contacting insurers can be risky, however, because the insurer typically will cancel the building's insurance with a 30-day notice, and so, says Ringler, "those 30 days are the ones in which the owner will start a fire." The firehouse group teaches the tenants to be especially vigilant during that time. They are taught to look for warning signs, such as a buildup of trash and flammable materials in the basement or people mysteriously moving refrigerators and stoves out of the building. The firehouse group then may ask the fire marshall to investigate.

At the National Bureau of Standards,

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Snell and his colleagues are developing a system that, they expect, will make a dramatic difference in the way individual homeowners think about fires. Most fires and most fire deaths occur in single-family dwellings, which is to be expected because three-quarters of Americans live in one- or two-family dwellings. What Snell's group has done is to make a computer model of how a fire grows—a task that as recently as a decade ago seemed impossible. "Until recently, they could not even model a burning log," says Schaenman. "Fire marshals used to joke that their models just told them that smoke rises."

The advances were made possible by increased computer power and by basic research on the physics and fluid dynamics of fires. "Fires are very complex. It is very difficult to predict fire growth," says Snell. When a fire is in a compartment, such as a room, the fire starts to grow and heat rises. Heat and smoke start to accumulate at the ceiling. As they accumulate, the smoke layer gets larger and starts to descend. It heats the immediate surface of the fire and reradiates heat back, which increases the rate of burning. "The process grows exponentially," Snell says, "until everything and everyone in the compartment is hot enough to ignite. It goes from a situation where an item or items are burning to one in which everything is on fire, like a furnace or a blowtorch. Then the flames belch out the door and the process continues in the next spaces."

This process, called flashing over, can occur in a matter of minutes. In fact, says Schaenman, many people have died calling the fire department, not realizing that they have only 2 or 3 minutes from the time a fire is a small flame in a corner of the room to the time the room explodes with fire. The casino at the Dupont Plaza flashed over, which is why, Snell suspects, people at first thought that the fire was set by explosives. The flashover process can sound like an explosion.

Now that researchers can model fire growth with computers, they can begin to build simulators to show what can happen when fires start in homes. "You can use simulators to see if fire protection measures are adequate and to see how vulnerable buildings are to arson or terrorist attacks," Snell says. In addition, Snell's group is incorporating human behavior in its model. The investigators have learned how people typically behave in fires by interviewing survivors of fires. For example, they find that when a fire occurs in the home of a two-parent family, the father usually goes to investigate and calls the fire department while the mother rounds up the children.

Snell and his colleagues have a pilot computer program that illustrates the way a simulator could work. "You describe the building, its contents, and the occupants to the computer. The computer tells you that if you start this kind of fire of this magnitude how many would die. You then can try different behavioral strategies and ask if people have time to escape." What you see on the screen is a diagram of a house with a fire spreading in it.

For example, Snell says, suppose a family lives in a two-story house and has just one smoke alarm upstairs where they are sleeping. Then suppose a fire started in the family room on the first floor. The family room will flash over in 1 to 3 minutes. "It is very likely that by the time the smoke alarm upstairs goes off, it will be a footrace to survive." Now, suppose there is a smoke alarm on the first floor as well. The scenario changes and the family has time to escape.

The National Bureau of Standards validates its physical models by running "burns." It has a townhouse complex that it sets on fire to establish whether temperature flows and smoke patterns are as predicted. So far, says Snell, the model is accurate.

Within a decade, Snell expects that the fire simulator will be available for use on personal computers and will be distributed commercially. Then, he says, "there will be almost a revolutionary change." The simulator could be used routinely in schools, for example, and could be offered at fire departments so that people could plug in information about themselves and their homes and could see whether they are at risk of dying in a fire and, if so, how to change their behavior. "People don't realize how vulnerable they are to being trapped by a fire," says Snell. "If they experience life-threatening fires in a simulator, they will develop strategies and will never forget them." ■

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