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Investigation of Confined Structure Fires

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Findings

- Confined structure fires account for 37% of all reported structure fires and 38% of residential structure fires.
- Per fire, confined fire losses are far lower than the average structure fires. Less than 14% of confined structure fires reported losses.
- More than half (57%) of all confined structure fires are confined cooking fires.
- Inattentive behavior is the most common human factor that results in confined fires.

Confined structure fires are small fire incidents that are limited in scope, are confined to noncombustible containers, rarely result in serious injury or large content losses, and are expected to have no accompanying property losses due to flame damage.¹ This topical report is a summary of a detailed analysis of the characteristics of small fires that occur in structures that are contained or confined as recorded in the U.S. Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS).²

CONFINED FIRES AND UNREPORTED FIRES

Information on small confined structure fires has been available in the past via the NFIRS data, but analysts have been aware of data collection issues that may have precluded full reporting of all these small fire incidents. In response to these concerns, NFIRS 5.0 includes new incident types and abbreviated reporting that are specifically designed to identify these small fires and facilitate data collection.

Studies of the unreported fire problem indicate that unreported fires tend to be small, low-loss confined or contained fires. This investigation into similar fires—confined structure fires—may shed light on the characteristics of unreported fires as well. Even the largest fire starts small; hence, all fires, regardless of size, merit prevention attention and analytic investigation.

The 2002 NFIRS 5.0 data contain abbreviated reporting for slightly over 52,000 confined structure fire incidents—37% of structure fires. These incidents accounted for \$26 million in combined losses, 3 deaths, and nearly 500 injuries. Per fire, these losses are far lower than the average structure fire in 2002 (Figure 1).

FIGURE 1. 2002 LOSS MEASURES FOR CONFINED STRUCTURE FIRES

Loss Measure	All Structure Fires	Confined Structure Fires
\$ Loss/Fire	\$14,252	\$498
Injuries/1,000 Fires	30.5	9.1
Fatalities/1,000 Fires	5.1	<0.1

Source: NFIRS 5.0 data only

DISTRIBUTION OF FIRES

More than half of all confined fires are confined cooking fires. Of the 52,006 confined fires reported through NFIRS in 2002, 57% were cooking fires, 19% were trash or rubbish fires, and 17% were chimney fires. When heating-related confined fires (chimney and fuel burners) are grouped together, these types of confined fires become the second leading group of fires at 23% (Figure 2). Most confined structure fires (77.5%) occurred on residential properties.

As a result of this distribution, the cause profiles for reported structure fires, especially residential structure fires, have undergone an important change.³ Confined structure fires account for 38% of all reported residential structure fires in the NFIRS 5.0 data. Confined fires account for over half (53%) of those residential fires where cause information is available.

FIGURE 2. CONFINED STRUCTURE FIRES BY INCIDENT TYPE (2002)

Incident Type	Fires	Percent
113 Cooking	29,706	57.1
114 Chimney Fires	8,638	16.6
115 Incinerator	284	0.5
116 Fuel Burner	3,226	6.2
117 Commercial Compactor	246	0.5
118 Trash/Rubbish	9,906	19.0
Total	52,006	100.0

Source: NFIRS 5.0 data only

Loss

By definition, losses associated with confined fires are limited to the contents of the container, and such losses are expected to be minimal. Likewise, a fire confined to its container of origin is not expected to generate much, if any, property loss.

The collected data, however, show exceptions to this definition. Of the 52,006 confined fires in the 2002 data, 13.6% reported losses. These losses averaged \$3,657 with the average property loss (\$2,058) exceeding the average content loss (\$1,599). Property losses were reported in 4,711 confined fire incidents, representing 9.1% of all confined fires in the NFIRS data that year. Content losses were reported for 4,520 incidents, slightly less than 9% of confined fires. Details are shown in Figure 3.

FIGURE 3. DOLLAR LOSS SUMMARY, CONFINED STRUCTURE FIRES (2002)

Loss Category	Fires	%	Overall Loss	%	Loss/ Fire	Contents	Loss/ Fire	Property	Loss/ Fire
Contents Only	2,368	4.6	\$2,743,893	10.6	\$1,159	\$2,743,893	\$1,159	—	—
Property Only	2,559	4.9	4,973,152	19.2	1,943	—	—	\$4,973,152	\$1,943
Contents and Property	2,152	4.1	18,169,987	70.2	8,443	8,572,802	3,984	9,597,185	4,460
Any Content Loss	4,520	8.7	20,913,880	80.8	4,627	11,316,695	2,504	9,597,185	2,123
Any Property Loss	4,711	9.1	23,143,139	89.4	4,913	8,572,802	1,820	14,570,337	3,093
Any Loss	7,079	13.6	25,887,032	100.0	3,657	11,316,695	1,599	14,570,337	2,058
No Losses	44,927	86.4		—					
Overall	52,006		\$25,887,032		\$498	\$11,316,695	\$218	\$14,570,337	\$280

Source: NFIRS 5.0 data only

FIRES WITH CONTENT LOSS ONLY

For those fires that are more closely associated with the original intent of the confined fire concept—those with only content losses and minor injuries—only 11.7% have content losses in excess of \$1,000. When the group of fires with content loss includes all fires with content losses (that is, those fires above with only content losses and fires that have both content and property losses), the average total losses increase substantially. Not surprisingly, the fires with the greatest total loss also tend to have more fire spread.

INJURIES

While confined fires were designed to capture no-loss fires, as with contents loss, it is reasonable to expect some injury associated with these fires. It is conceivable, for example in a confined cooking fire, that an individual sustained a burn either in the ignition of the fire or in reaction to the fire (e.g., placing a lid on the container). Confined fires reported to NFIRS in 2002 resulted in 471 injuries, 82.2% of which occurred in residential properties. Confined cooking fires resulted in the largest number of injuries.

FIRE SPREAD

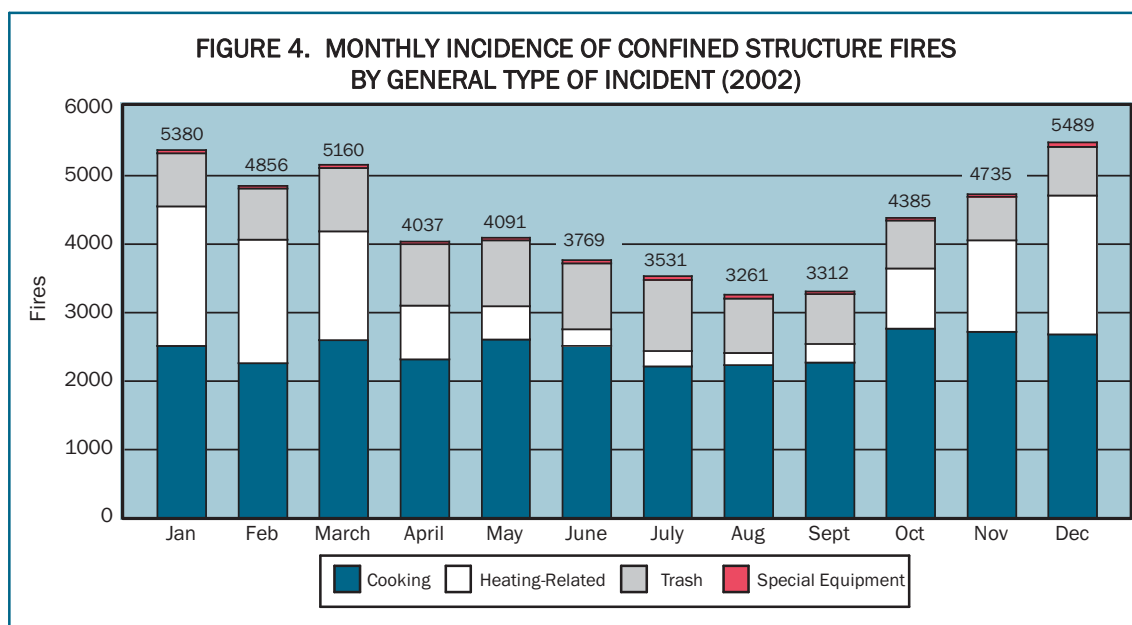
As expected, virtually all confined fires are restricted to the object of origin (99.1%). Only 3.3% of confined fires with content or property loss move beyond their containers, and these obviously have the highest losses per fire, as noted above.

HUMAN FACTORS

Human intervention, neglect, or inappropriate behavior can all result in fire incidents. Based on the NFIRS fire reports that included fire module data, unattended heat use or unsupervised activities are the most common human factors (65.5%) that result in confined fires, and 85.2% of these cases are from unattended cooking. Sleeping occupants (11.8%) and the age of residents (8.4%) are the next most important human factors contributing to confined structure fires.

MONTH OF YEAR

As can be seen in Figure 4, it is the pattern of heating-related incidents (confined chimney and confined fuel burner fires) that explain the overall pattern in monthly trends of confined structure fires. The majority of confined fires occur between October and March with peaks in the winter (December–January). Confined structure cooking fires are relatively steady throughout the year with slightly fewer confined cooking fires occurring in the summer months. Although cooking is the predominant reason for a confined fire, the overall trends are little affected by the number of these fires each month.



Based on 52,006 incidents or cases reported to NFIRS.
Source: NFIRS 5.0 data only

Trash and rubbish fires are more numerous during the late spring and early summer months, perhaps a by-product of increased outdoor activity in these months. In the 2002 data, there were more confined trash fires (9,906) than chimney fires (8,638). Confined incinerator and commercial compactor fires (combined as “special equipment” in Figure 4) averaged 44 per month in the NFIRS data, with a slight increase in the summer months. Their influence on the overall monthly trends in confined fires is extremely limited.

TIME OF DAY

Confined fires typically occur during waking hours. The hourly distribution of these fires are dominated by that of cooking fires and tend to peak with the lunch and dinner hours.

SMOKE ALARMS

Smoke alarms play a vital role in the early detection of confined structure fires. In the more than half of confined fires (53%) where alarm alert information was provided, alarms alerted occupants 63% of the time.⁴ Where more detailed information is provided in the fire module, smoke alarms operated in 71% of the incidents. But some confined fires were just too small to cause the alarm to operate, and in a very limited number of cases the alarm failed to operate altogether.

CONCLUSION

Confined structure fires are predominately the result of cooking fires and, where additional information was given, inattentive behavior.

To ensure the robustness of the data collected under the new abbreviated reporting option of NFIRS 5.0, several data collection concerns need to be addressed. Two issues are noteworthy: the definition of confined fires and loss thresholds. Structures other than buildings are included as are fires that incur damage beyond the containers. As well, often enough the container itself is damaged and casualties may result from even the smallest fires. These and other considerations should be pursued more thoroughly to improve both NFIRS data quality overall and the usefulness of the data collected on confined fire incidents.⁵

In addition, this preliminary analysis of confined fire incidents has led to a new understanding of the analyses involved in determining the presence and effectiveness of smoke alarms in all structure fires as well as in these confined fires. Further investigations into the appropriate methodologies for smoke alarm analyses would be useful to the fire community at large.

To request additional information or comment on this report, visit
<http://www.usfa.fema.gov/applications/feedback>

Notes:

1. NFIRS distinguishes between “content” and “property” loss. Content loss includes loss to the contents of a structure due to damage by fire, smoke, water, and overhaul. Property loss includes losses to the structure itself or to the property itself. Total loss is the sum of the content loss and the property loss. For confined fires, the expectation is that the fire did not spread beyond the container (or rubbish for incident type 118) and hence, there was no property damage (damage to the structure itself) from the flames. There could be, however, property damage as a result of smoke, water, and overhaul.
2. The analyses presented here are based on the analytic report, *Confined Structure Fires*, USFA, February 2006.
3. It is important to note that it is the cause profile of the reported data that has changed. This change may not necessarily indicate a change in the fire situation, only in the understanding of the fire situation.
4. The percentage of occupants alerted varies slightly (from 63% to 65%) depending on the methodology used to analyze the data. That separate methodologies yield similar results gives support to the results.
5. These and other recommendations are discussed in *Confined Structure Fires* (see footnote 2 above).