

# PRODUCT SAFETY ISSUES

## Product Safety Issues Juvenile Fire-setter Intervention Project

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#### OVERVIEW OF THE PROBLEM

Juvenile-set fires cost lives and property. In 1996, the estimated 87,330 fires caused by children playing with fire resulted in 280 deaths and 2,400 injuries. These statistics do not include those fires where a child or adolescent was involved in a suspected arson. With those fires included, the numbers would undoubtedly be much higher. In fact, if Justice Department arrest statistics hold true for all suspected arson fires, these loss number could be as high as 200,000 fires; 500 deaths; 3,300 injuries; and \$840 million in property damage. These numbers are staggering. While much has been done in the area of juvenile fire-setter intervention and prevention initiatives, much more still needs to be accomplished: the loss statistics are too high.

Analysis of the 1995 to 1997 NFIRS data indicates that the leading cause of fire deaths among children under the age of 13 is playing with fire, often with matches and lighters. Some sources indicate that these fires cause 3 to 4 of every 10 preschool fire deaths. While curiosity about fire is considered normal, fire-play and fire-setting by children is generally symptomatic of other needs. A lack of education about fire and fire safety or a combination of this together with more serious psycho/social/emotional or physical needs is the most common problem area identified. Although this behavior in many instances (especially among very young children) can be due to a relatively innocent curiosity, fire-play and fire-setting is never harmless and should always be taken seriously by adults. Children as young as 18 months have started extremely serious, devastating fires.

Matches and lighters are the primary sources of ignition for children playing fires. In earlier years, most matches could be ignited anywhere where friction could be made--from the surface of the street to the soles of shoes. These features were inherently dangerous and changes were made prevent accidental ignitions. Most matches today require the matchbook to be present when igniting the match.

To prevent or minimize juvenile set fires, many products have been enhanced to include child-safety devices. Most cigarette lighters on the market today feature child-lock devices on them. Though easy to disengage for the common adult, these features have been designed to deter children under the age of 5 from playing with cigarette lighters.

Though the match and lighter are two obvious items that juvenile fire-setters use as a source of ignition, other fire-causing products have been developed with child deterrence in mind. Gas stoves are an example of this. Older gas stoves featured knobs that were located at the eye-level of the small child. Children, watching and imitating adult behavior, learned to turn on these stoves which, without intervention, could have catastrophic consequences depending on the status of the pilot light. With a functioning pilot light, the stove would turn on and the open flame could be used as an ignition source. If the pilot light were out, a build-up of natural gas could potentially lead to a devastating explosion. Today's stoves, however, are manufactured with the controls on the countertop and out of view of younger children. Many of these controls require the user to push and turn a knob to ignite the pilot light and turn on the stove.

Portable space heaters are also a source of residential fires today. Space heaters give off an abundant amount of heat and often ignite combustible products that come in close contact with them. Currently, space heaters, however, are manufactured with fire safety features. For

instance, regulations require space heaters to have a thermostat with an automatic cut-off when the unit reaches a certain temperature. Space heaters are also required to have tip-over shutdown feature that automatically turns the heating product off if it is knocked over. These enhancements are safety features that can also be deterrents to fire-play.

Yet, these features can be improved to virtually eliminate the potential for fire. Is this feasible? Is the trade-off between ease-of-use and fire-safety worthwhile? Arguments can be made for both viewpoints. This study seeks to address product safety issues such as these. Emphasis is placed on product safety enhancements that can be effective in reducing the incidence of juvenile fire-setting.

### **What is a Juvenile Fire-setter?**

Curiosity about fire is a natural interest in all children. Curiosity is differentiated from setting fire, which is not a natural, expected behavior. Children may set one fire out of curiosity or by accident, but setting more than one fire (regardless of the extent of damage or the age of the child) may indicate a more serious problem. Repetitive fire-setting by juveniles signals a need for greater concern, an in-depth mental health evaluation, and intervention for the fire-setter and his or her family by trained professionals. The need for fire safety education for the entire family is also indicated. Depending on the age of the child and the circumstances surrounding the child's development and environment, the juvenile court system may become involved.

Fireplay is a deadly game that should not be dismissed as a "phase" or simple "curiosity." Children must be properly supervised and educated by guardians both at home and at school about fire's destructive power. Nationwide, fire departments have implemented intervention programs to identify and stop juvenile fire-setting. Early detection and treatment are essential to

prevent normal childhood curiosity from turning into more serious fire-setting. Juvenile fire-setting can be prevented when parents, teachers, firefighters, law enforcement authorities, and all care providers become aware of fire-setting.

### **Profile of a Fire-setter**

Experts classify fire-setters into a series of categories depending on the severity of the problem. While the precise boundaries of these categories may change from program to program or from expert to expert, the following four categories are generally indicative of the gradations of juvenile fire-setters.

*Curious Fire-setters.* Many young children are fascinated by matches and lighters but are not aware of fire's destructive consequences. Children set fires because of curiosity or because of poor judgment; young children imitate adults who light cigarettes, candles, or fireplaces. Unfortunately, the lack of parental supervision or education about fire safety is usually a factor. There are no "accidental" childplay fires. These are fires that are purposefully set but with no intended purpose and are "unintentional" in nature.

*Troubled Fire-setter.* Mental or emotional disturbances can cause fire-setting behavior. Ages of troubled fire-setters can range from preschoolers through teenagers. These children often set fires as a way to act out anger, frustration, and feelings of being powerless.

*Delinquent Fire-setters.* These are youths usually in their teens with a history of fire-setting. They start fires as an act of vandalism or for creating excitement. Delinquent fire-setters are frequently influenced by their peers and use fire to cause malicious mischief or rebel against authority. Abandoned buildings, open fields, and schools are common targets. These fire-setters may also have a history of anti-social behavior, lying, stealing, truancy, and drugs.

*Severely Disturbed Fire-setters.* These youths often have a long history of behavioral problems. Their symptoms usually fall into two major personality types: ‘impulsive neurotic’ and ‘borderline psychotic.’ It is not unusual for these fire-setters to be in state mental or correctional facilities.

## TECHNICAL APPROACH

“Out of sight, out of mind” is a phrase often heard by parents when they explain why injurious items and objects are placed out of harm’s way from their young children. But what if the item, such as a stove, cannot be removed or put away? What can be done to reduce the potential for these items to harm children? Gas stoves that require a dual action (such as push and turn) to ignite are one such innovation. In much the same way, products can be enhanced to reduce their potential for being involved in fire ignition. Child-resistant lighters are an example of this type of enhancement. Product enhancements of this kind often have the added benefit of reducing the incidence of juvenile fire-settings. To identify these products and determine what qualities are those that deter their use is an important step in addressing juvenile fire-setting prevention strategies.

The TriData team’s technical approach to investigating product safety issues of the juvenile fire-setting problem encompassed the following areas:

1. Determine the products most commonly involved in juvenile fire-setting;
2. Investigate products identified by the Consumer Product Safety Commission (CPSC) as potential fire hazards, both those products identified as ignition sources and as flammable items;

3. Research potential or proposed product enhancements to products identified as ignition sources and as the items ignited;

4. Propose additional enhancements or strategies based on both the products most commonly involved in juvenile fire-setting and the study team's research.

This study concentrated on those products that primarily affected children under age 13. The products investigated encompassed those that were (or could be) involved in unintentional fires as well as a limited number of products (such as flammable liquid containers) that have been used in more deliberately set juvenile fires.

The remainder of the report is organized into four sections. The first section addresses materials and products commonly used by juvenile fire-setters. It includes a short analysis of national fire incident data for children playing fires as well as a summary of products found in juvenile fire-setting literature and from interviews with professionals who deal with children who have set fires. The next two sections address current product safety enhancements and potential product safety enhancements and product strategies. A short conclusion completes the study report.

## **MATERIALS AND PRODUCTS COMMONLY USED BY JUVENILE FIRE-SETTERS**

Before the study team began research into product enhancements that would help or that have helped to reduce the incidence of juvenile fire-setting, it was necessary to establish what materials and/or products were involved in fires with children under the age of 13. The TriData team chose a three-pronged approach. The team first analyzed the available National Fire Incident Reporting System (NFIRS) data to establish the overall range of items that were used to ignite fires, the items that were ignited, and whether/what, if any, equipment was involved in the

fire. Second, the team performed a limited review of juvenile fire-setting literature and product safety literature to find products identified in juvenile-set fires. The third source of information was interviews with individuals who deal with juvenile fire-setters in some professional capacity--e.g., psychologists, public fire educators, juvenile intervention specialists, fire investigators, and the like. The team felt that all three of these sources were necessary to investigate, as objective data does not always convey the nuances of a situation and subjective data (the interviews) may only reflect a portion of the overall juvenile fire-setting picture.

The NFIRS data analysis, combined with the interviews and literature review, provide a reasonably comprehensive overview of products and materials involved in juvenile fire-setting. With this background, the team felt that safety enhancements that can help reduce the incidence or severity of juvenile fire-setting could be more easily identified.

### **NFIRS Data Review**

The NFIRS data was the data source for the analysis of products used by juveniles in fire-setting. The NFIRS data contains a wealth of fire incident information and is the largest set of fire incident data in the world. While the system is voluntary, information is collected on nearly 700,000 fire incidents each year--about a third of the estimated fires reported annually in the U.S. All states and all fire departments within them have been invited to participate in NFIRS. Participating fire departments collect a common core of information on fire and fire casualty incidents using a common set of definitions. This core of information reflects details on such fire-related data as the type of property where the fire took place (e.g., structure), the material initially ignited (e.g., fabric), the form of this material (e.g., bedding), the form of the heat of ignition of the fire (e.g., matches), numbers of injuries and deaths, along with many other fire-

related data items. The data may be collected via paper forms or via computerized data entry.

Fire departments send these data as a set of paper reports, an electronic file, or on computer tape to their state fire data office where the data are edited and collated. The states' data are sent to the U.S. Fire Administration and are further validated. Data on individual fire incidents and casualties are preserved incident by incident.

Initially, the team reviewed summary data on both children playing fires and incendiary or suspicious fires to determine products that are used by children to start fires. As NFIRS does not provide the means to differentiate fires by the perpetrator, fires set by very young fire-setters may be determined to be caused by children playing; fires set by older juveniles may be coded as incendiary or suspicious. It was understood that those incendiary and suspicious fires (commonly referred to as 'arson' fires, although these fires are not arson fires in the legal use of the term 'arson') reflected fires that could be committed by individuals of all ages. Three data items were of most interest for product-related analyses: form of heat of ignition (what ignited the fire), form of material first ignited (what was lit that first caught fire), and equipment involved in ignition (the equipment, if any, that was intimately involved in setting the fire).

The NFIRS arson fire incident data and the children playing fire incident data revealed markedly different profiles for the three data items of interest. For example, in the arson fires incendiary devices played a prominent role as an ignition source where as they were less important in children playing fires. While a large share of arsonists are thought to be juveniles, the focus of the analysis for this effort was on juveniles, under age 13, who set fires either through curiosity, unintentionally, or without a full understanding of the potentially devastating consequences. After reviewing the data, consulting with Consumer Product Safety Commission

(CPSC) and National Fire Protection Association (NFPA) staff, and after team member discussions it was decided that the NFIRS data analysis should more properly be limited to only those fires classified as children playing fires.

The three tables below are a summary of the top ten ignition sources, objects ignited, and equipment involved in ignition for the 1995 to 1997 NFIRS fire incidents coded as children playing fires. Two summaries are shown in each table. The first, “all fires” includes any fire coded as a children playing fire, to include fires outside of structures, fires in institutions and stores as well as other non-residential structures, residential structure fires, and vehicle fires. The second summary is for residential fires only. Residential fires were examined separately as both the literature survey and the interviews suggested that most fireplay for children under 13 occurs in or around the home.

Matches are the leading ignition source in both sets of fires (Table 1). Matches account for the ignition source in half of all children playing fires and in nearly 40% of residential children playing fires. Lighters are the second most common ignition source in both sets of fires. What is interesting is that lighters play a larger roll in residential children playing fires than in all fires. Together matches and lighters account for nearly three-fourths of ignition sources specified in children playing fires.

**Table 1: Ignition Source for Children Playing Fires**  
**(Form of Heat of Ignition, NFIRS, 1995-1997)**

| RANK | ALL FIRES   |        |                      | RESIDENTIAL FIRES                                 |       |                      |
|------|---|--------|----------------------|---|-------|----------------------|
|      | Form of Heat of Ignition                          | Count  | Percent of Incidents | Form of Heat of Ignition                          | Count | Percent of Incidents |
| 1    | Match   | 24,591 | 50.1                 | Match   | 9,416 | 39.5                 |
| 2    | Lighter   | 11,723 | 23.9                 | Lighter   | 8,187 | 34.3                 |
| 3    | Fireworks   | 4,115  | 8.4                  | Fireworks   | 1,056 | 4.4                  |
| 4    | Candles   | 1,116  | 2.3                  | Candles   | 1,006 | 4.2                  |
| 5    | Other Open Flame                                  | 1,112  | 2.3                  | Other Open Flame                                  | 575   | 2.4                  |
| 6    | Cigarette   | 891    | 1.8                  | Heat From Properly Operating Electrical Equipment | 485   | 2.0                  |
| 7    | Open Fire   | 707    | 1.4                  | Heat From Gas Fueled Equipment                    | 445   | 1.9                  |
| 8    | Other Smoking Material                            | 575    | 1.2                  | Cigarette   | 384   | 1.6                  |
| 9    | Other Open Flame                                  | 531    | 1.1                  | Open Fire   | 267   | 1.1                  |
| 10   | Heat From Properly Operating Electrical Equipment | 511    | 1.0                  | Other Open Flame                                  | 258   | 1.1                  |

What is ignited in children playing fires depends on the location (Table 2). Over half of all children playing fires occur outside of structures. This location is reflected in the material ignited--in one-third of all children playing fires the material ignited is some sort of wood (twigs, grass, brush material). In the home, mattresses and bedding are nearly equally ignited and are involved in over one-fourth of the children playing fire incidents. Rubbish and trash are prominent in both data sets, ranking second for all children playing fires and fourth for residential

children playing fires. Paper goods (magazines and paper) are not shown as significant factors, accounting for 3% to 4% of the 1995 to 1997 children playing fires. Equipment is rarely found to be involved in children playing fires (Table 3). When equipment is a factor, it is most likely to be a stove.

**Table 2: Object Ignited in Children Playing Fires**  
(Form of Material Ignited, NFIRS, 1995-1997)

| RANK | ALL FIRES                          |        |                      | RESIDENTIAL FIRES                  |       |                      |
|------|------------------------------------|--------|----------------------|------------------------------------|-------|----------------------|
|      | Form of Material Ignited           | Count  | Percent of Incidents | Form of Material Ignited           | Count | Percent of Incidents |
| 1    | Forest, brush, grass               | 16,311 | 32.2                 | Mattress, pillow                   | 3,314 | 13.8                 |
| 2    | Rubbish, trash                     | 8,162  | 16.1                 | Bedding, blanket, comforter, sheet | 3,280 | 13.7                 |
| 3    | Mattress, pillow                   | 3,646  | 7.2                  | Forest, brush, grass               | 2,536 | 10.6                 |
| 4    | Bedding, blanket, comforter, sheet | 3,401  | 6.7                  | Rubbish, trash                     | 2,177 | 9.1                  |
| 5    | Wearing apparel not on a person    | 2,231  | 4.4                  | Wearing apparel not on a person    | 2,046 | 8.5                  |
| 6    | Upholstered furniture              | 1,965  | 3.9                  | Upholstered furniture              | 1,409 | 5.9                  |
| 7    | Magazine, newspaper, writing paper | 1,710  | 3.4                  | Magazine, newspaper, writing paper | 1,103 | 4.6                  |
| 8    | Structural member                  | 913    | 1.8                  | Curtain, blind, drapery, tapestry  | 579   | 2.4                  |
| 9    | Box, carton, bag                   | 702    | 1.4                  | Floor covering, surface            | 501   | 2.1                  |
| 10   | Fuel                               | 671    | 1.3                  | Structural member                  | 474   | 2.0                  |

**Table 3: Equipment Involved in Ignition in Children Playing Fires****(Equipment Involved in Ignition, NFIRS, 1995-1997)**

| RANK | ALL FIRES                                   |        |                      | RESIDENTIAL FIRES                           |        |                      |
|------|---|--------|----------------------|---|--------|----------------------|
|      | Equipment Involved in Ignition              | Count  | Percent of Incidents | Equipment Involved in Ignition              | Count  | Percent of Incidents |
| 1    | No equipment involved                       | 41,581 | 90.9                 | No equipment involved                       | 19,588 | 87.8                 |
| 2    | Fixed, stationary surface cooking unit      | 553    | 1.2                  | Fixed, stationary surface cooking unit      | 528    | 2.4                  |
| 3    | Other processing equipment                  | 424    | 0.9                  | Fixed, stationary oven                      | 136    | 0.7                  |
| 4    | Vehicle                                     | 245    | 0.5                  | Other processing equipment                  | 104    | 0.6                  |
| 5    | Fixed, stationary oven                      | 168    | 0.4                  | Lamp, lightbulb                             | 102    | 0.6                  |
| 6    | Torches                                     | 127    | 0.3                  | Fixed, stationary local heating unit        | 72     | 0.5                  |
| 7    | Lamp, lightbulb                             | 112    | 0.2                  | Torches                                     | 69     | 0.3                  |
| 8    | Fixed, stationary local heating unit        | 109    | 0.2                  | Portable local heating unit                 | 67     | 0.3                  |
| 9    | Unclassified processing equipment           | 82     | 0.2                  | Portable appliance designed to produce heat | 61     | 0.3                  |
| 10   | Portable appliance designed to produce heat | 80     | 0.2                  | Lighting fixture, lampholder, ballast       | 61     | 0.3                  |

### Limited Literature Review

A variety of articles and technical reports along with three separate sets of case studies were read or consulted to determine what products or materials were cited as being used in juvenile set fires. Additional article annotations were also reviewed. While informative on many aspects of juvenile fire-setting and related behavior, the general literature does not universally detail the items used in fireplay. When noted, the majority of the literature acknowledges that

matches and lighters (presumably cigarette lighters) were the resources most commonly used to ignite the fire. The case studies also indicated that match play and lighter play were commonly involved in juvenile fire-setting. The materials ignited range from trash and brush to mattresses, bedding, and furniture.

The technical reports were more substantive in quantifying the items used in fire play. Matches and lighters were the ignition sources most frequently cited in these reports. The items typically ignited in juvenile-set fires were paper, clothing, bedding (including mattresses), furniture, and leaves/brush.

## **Interviews**

Interviews with professionals who work with juvenile fire-setters or juvenile fire-setter intervention programs were used to gather several types of information. The first component sought through the interviews was to find out if, in their experience, there was a relationship between the products or materials used in fire-setting, either in the choice of ignition or the choice of material ignited, and the age of the child. The second component of interest was to try to understand the mechanics of the fire-setting situation: how the child acquired the product or materials involved in the fire, why the products or materials were chosen, where the fires were started and why, and if the interviewee had any suggestions for or insights into potential product enhancements to prevent a repeat of these fires. These individuals are very familiar with the circumstances surrounding specific fire-setter cases--their hands-on experience with the children and with prevention strategies yielded interesting ideas for changes to products that could augment reductions in juvenile fire-setting.

Through recommendations and the study team's own contacts, the potential interviewee list included 51 professionals from a variety of areas related to the juvenile fire-setting problem. Potential interviewees were sought who reflected experience or expertise in the following areas:

1. Fire Service
2. Investigation/fire marshal office
3. Fire prevention
4. Fire-setter program
5. Youth counseling
6. Child/adolescent psychology
7. Fire intervention direct services
8. Burn expertise
9. Policy/research

Forty-five of the 51 candidates were contacted; 19 candidates were available to participate in a 40- to 60-minute interview. The protocol for the interviews is attached as Appendix A. The list of the candidate interviewees is attached as Appendix B. The team was successful in interviewing individuals from eight of the nine target areas of expertise. Unfortunately, none of the burn professionals on the candidate list were available for interview. The combined professional (

Table 4) and current (Table 5) experiences with juvenile fire-setters of the interviewees gave the team the opportunity to gather information on the items used in juvenile fire-setting from a variety of perspectives. The interviewees typically had experience in several disciplines and were involved in several aspects of the juvenile fire-setting problem.

**Table 4: Background and Professional Experience of Interviewees**

| BACKGROUND                                | CURRENT | PAST | TOTAL | PERCENT* |
|---|---------|------|-------|----------|
| Fire Service                              | 11      | 1    | 12    | 63       |
| Investigator/fire marshal                 | 4       |      | 4     | 21       |
| Fire prevention personnel/educator        | 13      |      | 13    | 68       |
| Fire-setter program personnel/coordinator | 14      | 1    | 15    | 79       |
| Youth counseling                          | 9       |      | 9     | 47       |
| Child/adolescent psychologist, etc.       | 2       |      | 2     | 11       |
| Fire intervention direct services         | 4       | 2    | 6     | 32       |
| Policy/research                           | 4       | 1    | 5     | 26       |

\* The percentages add to more than 100 because the interviewees had experience in more than one area.

**Table 5: Primary Experience of Interviewees with Juvenile Fire-setters**

| BACKGROUND                        | NUMBER | PERCENT* |
|-----------------------------------|--------|----------|
| Incident investigation            | 5      | 26       |
| Child counseling                  | 9      | 47       |
| Family counseling                 | 8      | 42       |
| Guidance clinic                   | 2      | 11       |
| Probation control.                | 3      | 16       |
| Education/intervention            | 5      | 26       |
| Educational materials development | 1      | 5        |
| Interview/evaluation              | 4      | 21       |
| Program management                | 2      | 11       |

\* The percentages add to more than 100 because the interviewees were involved in several aspects of the juvenile fire-setting problem.

From the interviews, a number of observations can be made:

*Ignition Source.* The interviewees consistently noted that the ignition sources were nearly always matches and lighters for children ages 5 to 12. There was disagreement on which of these two items was the most prevalent. Some interviewees (Kolko, Porth) said that matches were by far the most common; in others' experiences (Adams, Burns, Rea, Scott), lighters were

far more prevalent. Still another (Day) found matches and lighters used equally. Matches were noted by one (Guarnieri) as being easier to use for younger children (age not specified). Others (Folger, Scott) maintained that young children (age not specified) were defeating the safety mechanisms of the lighters and chose them over matches. For children under age 5, most interviewees note that lighters were used. Design changes to both lighters and matches were noted as necessary.

*Accessibility.* All the interviewees noted that the one key reason in the choice of the ignition was that it was accessible. Most interviewees said that for children under 13, the matches or lighters were available in the house, usually “left in plain sight, available to the child.” For older children (8 to 12), matches were also available from counters at drug and convenience stores. One interviewee (Peterson) said that Massachusetts was considering legislation to make it illegal for matches and lighters to be sold to minors; others (Guarnieri, Rea) noted that many items cannot be sold to minors, such as tobacco (nationally) and spray paint (locally). It was observed that if access to these items by a minor can be regulated, why not regulate access to lighters and matches? While most children did not necessarily seek out the ignition sources, the accessibility made it easy for them to acquire. The overall feeling from the interviewees was that until the accessibility problem was solved, the product enhancement was secondary.

*Supervision.* Hand-in-hand with accessibility was the issue of supervision. Nearly all the interviewees indicated that the fireplay incidents occurred during periods of little or no parental supervision. Moreover, several interviewees said that their experience was that cases of juvenile fire-setting tended to be dominated by single-parent families. (Adams, Arensberg, Gaugler, Scott, Wade, and others)

*Items Ignited.* Many of the interviewees noted that what was ignited was a function of what was available. Twigs, leaves, and papers were ignited outdoors. Indoors, the items ignited tended to be material (sometimes the clothing worn but more often clothing that was caught on fire as a result of the incident), bedding, mattresses, carpeting, or furniture that was located where the fireplay took place. That area was usually the bedroom. Two interviewees (Kolko, Porth) described a “learning curve” of materials in which the first item ignited was paper or paper products. Kolko maintained that as the fireplay progressed, the items advanced to more substantial ones. Porth maintained that most data collected on the “material first ignited” in NFIRS and similar data collection systems was inaccurate. In his experience, the majority of fires, even those involving bedding and furniture, were the result of out-of-control paper fires.

*Relationship between Age and Products.* There was no consensus on this question. Many interviewees saw this relationship as an accessibility issue--a child will explore with what is available. Others (Porth, Chappuis) saw this relationship as a developmental issue as the chronological age of the child is not necessarily consistent with the social and psychological age. There are very sophisticated 7-year-olds and very immature 12-year-olds. There are 5-year-olds with excellent fine motor skills and 10-year-olds who still have problems tying shoe laces. Again, others (Burns, Guarnieri) noted that younger children<sup>1</sup> (age not specified) tend to use matches and older children (age not specified) use lighters. Others (Adams, Folger, Porth, Scott), however, maintain that younger children use lighters and older children use matches. Most all the interviewees agreed that childproofing is not fool-proof and that child-resistant features are

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<sup>1</sup> While age ranges were not universally specified nor consistent, the term “younger children” generally meant children age 7 or under and the term “older children” generally meant children over age 7 but under age 13.

viewed by children as a challenge to overcome. In addition, there was concern about making products designed for adult use (yet child-resistant) to be difficult to use by adults themselves.

## **CURRENT PRODUCT SAFETY ENHANCEMENTS**

A wide variety of products have been (or are in the process of being) modified or improved to make them fire-safe or fire-resistant. Many of these product enhancements have, in turn, provided the opportunity to help reduce the incidence of juvenile fire-setting. While most of these improvements may not have been directed to the juvenile fire-setter population, they have nonetheless been beneficial.

We have placed product safety enhancements into three categories: ignition sources (the form of heat of ignition), fuels (form of material ignited), and protective devices. These three areas encompass the range of actions involved in fire-setting--the heat source, the item(s) ignited, and, where available, the options to alert or extinguish the fire. The choice of the items investigated results from the analyses performed on the 1995 to 1997 NFIRS data and the results of the discussions with the interviewees. The items are presented in rank order based on the NFIRS data presented in Tables 1 through 3.

### **Ignition Sources (Form of Heat of Ignition)**

*Matches.* A mandatory standard covers the design of matchbooks (16 CFR 1202). Originally published in 1977, the standard proposed comprehensive design and performance requirements for matchbooks. Much of the standard was overturned by a court decision stating that the incident data did not support the need for the performance requirements specified in the standard. The resulting standard, effective since 1978, provides certain design requirements such as requiring the friction to be on the outside back of the cover, the cover remains closed without

external force, matchheads cannot be cracked, and no part of a staple can be in contact with the friction.

Matches ranked first in the NFIRS data and accounted for half of all children playing fires. The interviewees disagreed on which ignition choice (matches or lighters) are most commonly used and for which age group. One expert (Kolko) maintained that matches were preferred in 70% of his cases (children aged 5 to 13). Another (Porth) observed that in his data, matches are not seen frequently in the younger ages (0 to 4), but are the predominant choice for the “curious” fire-setter aged 9 to 11. Lighters are preferred for the “serious” or “problem” fire-setter. Matches, like lighters, are heat sources that are readily available.

*Lighters.* One of the preferred ignition choices of juvenile fire-setters is a lighter. Lighters have relatively long flame duration, and, as noted earlier, are generally easy to operate and to acquire. Disposable and novelty cigarette lighters were identified by CPSC as substantial fire hazards for very young children (under age 5). This fire hazard has been addressed by mandatory standards (see below). Lighters, both standard and disposable, are not regulated for older children (over age 5) and rank second for all ages in fires caused by child play in the 1995 to 1997 NFIRS data. They accounted for nearly one-quarter of all children playing fires.

***Cigarette Lighters (current active CPSC project)*** – Effective July 1994, in response to a petition from a burn unit nurse who called attention to many burn injuries that occurred to young children, CPSC issued a mandatory standard that requires disposable and novelty lighters to be child-resistant (16 CFR 1210). The standard defines child-resistant to mean that 85% of the children under age 5 cannot successfully operate the lighter. The impact of the standard on burn injuries and deaths is currently under evaluation and the results of the evaluation are expected to

be available soon. While the target population for this standard is fire-setters under the age of 5, the child-resistant features may have some positive effect on children 5 and over as well. Unfortunately, the degree to which older children may (or may not) be protected by child-resistant features is unknown as no data nor studies in this area appear to be available.

*Utility (multi-purpose) Lighters, including micro-torches (current active CPSC project)* – These products are designed to light larger-load fires such as woodstoves and fireplaces. They are approximately 8 to 12 inches long and may be especially attractive to children because of their resemblance to pistols. A child-resistant standard was proposed in 1998 and CPSC approved a final standard in December 1999. This standard will become effective about December 2000.

*Fireworks (current active CPSC project)*. In response to serious injuries, mandatory product standards were established in 1973 to ban large firecrackers and similar devices and to require safety labeling of certain other fireworks devices (16 CFR 1500.14 (b)(7) and 16 CFR 1500.17 (a)(3)(8)(9)). This ban was followed in 1976 with additional regulations, again to address serious injuries, covering devices other than firecrackers (16 CFR 1507). These requirements included a prohibition of the use of certain chemicals, specifications for fuse design and performance, stability, leakage, and others. The size of reloadable tube aerial shells was limited in 1991 (16 CFR 1500.17 (a)(11)), the tip-over hazard of large multiple tube mine and shell fireworks was addressed in 1996 (16 CFR 1507.12 (a)(b)), and the fuse burn time requirement was increased in 1998 (16 CFR 1507.3 (a)(2)). Fireworks ranked third in fires caused by child play in the 1995 to 1997 NFIRS data and accounted for 8% of all children playing fires. Child play, however, accounted for 36% of fires involving fireworks.

*Candles (current active CPSC project).* CPSC is monitoring the development of an ASTM (previously the American Society for Testing and Materials) voluntary labeling standard (ASTM F15.45, Sub-committee on Candle Products). While labeling and other warning information are unlikely to be effective deterrents<sup>2</sup> they do provide, to those that read and heed them, an awareness of a potential problem. The labeling is expected to address (a) not leaving the area of a burning candle, (b) keeping candles away from children and pets, and (c) keeping candles away from combustible surfaces and materials. A voluntary performance standard is also being considered that addresses sooting and glass container thermal resistance and breakage. While candles ranked fourth in fires caused by child play in the 1995 to 1997 NFIRS data and accounted for only 2% of these fires, child play accounted for nearly 10% of all candle fires and 13% of deaths.

*Cigarettes.* Congressionally-mandated studies (Public Law 98-567 and 101-352) established that a safer cigarette was technically feasible (1987) and that a performance standard was practical (1993). Any federal regulatory action requires additional legislation. The issue has also been raised in some state legislatures. An ASTM voluntary test method is currently being considered (1998 to 1999). While cigarettes per se are not generally used by children in juvenile fire-setting (they account for less than 2% of children playing fires), it is interesting to note that tests at the National Institute for Standards and Technology (NIST) indicate that certain physical changes to cigarettes (reduced circumference, lower density tobacco, less porous paper, etc.) reduce the capability of cigarettes to ignite a furniture mock-up specimen.

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<sup>2</sup> McCarthy, R.L., Finnegan, J.P., Krumm-Scott, S., & McCarthy, G.E., (1984). Product information presentation, user behavior, and safety. Proceedings of the Human Factors Society 28<sup>th</sup> Annual Meeting, 81-85.

*Heaters and Heating Equipment.* Heaters and heating equipment accounted for less than 2% of residential children playing fires in the NFIRS data. However, these are heat sources that are readily available to children, especially in the winter months. Heating equipment can include central heating (usually using gas, fuel oil, propane, or electricity energy) and space or room heating (that can be either portable or fixed in place). Portable space heaters include kerosene and electric heaters that can be located in any room of the home and can provide ample opportunity for potential fire-setting. Fixed space heaters may include wood, gas, or electric heaters. Portable heaters appeared to be of greatest concern to the interviewees.

***Portable Electric Space Heaters (current active CPSC project)*** – Voluntary standard requirements such as tip-over resistance and improved grills were adopted based on CPSC staff recommendations during the 1985 to 1989 period (UL Standard 1278). Currently, recent fire incident data are being reviewed to determine the need to further upgrade voluntary performance standards and to assess the effectiveness of the 1991 voluntary standards revisions.

***Kerosene Heaters*** – Heater flare-up was identified as a serious problem. Existing voluntary standards were upgraded in the mid 1980s to include requirements for manual shutoff (in addition to the existing requirements for automatic shutoff in the case of a tip-over), minimum wick settings, and improved grilles (UL Standard 647). Improved labeling for flare-up and other issues was required in 1993 (UL Standard 647).

***Range Fires (current active CPSC project)***. CPSC is currently evaluating the feasibility of detecting incipient rangetop fires to prevent fire. Most range fires involve food cooking which is left unattended. The detection concept would turn the power off to the rangetop. This may prove to be of interest in juvenile fire-setting as young children have started

fires with stoves, as noted previously. When equipment is involved in child play fires, stoves and rangetops are most likely to be involved. Equipment is involved in only 6% of children playing fires; stoves and rangetops account for approximately 30% of these fires – or less than 2% of all children playing fires.

*Lamps (current active CPSC project).* The fire risk of bulbs, lamps, and the fixtures themselves have been investigated. In the mid 1990s, halogen lamps surged in popularity creating a dramatic increase in fires caused by the extreme heat generated by these tubular bulbs. In 1996, CPSC staff recommended to UL changes to their standard because of these fires. The standard was upgraded in 1998 to include a much lower limit on bulb wattage, a more stringent cloth drape test, more effective protective grills, tip-over requirements, and additional labeling. These became effective in 1999 (UL Standard 153). (Lamps, light bulbs, and light fixtures are covered by a various UL standards to include UL Standards 153, 298, 496, 542, 935, 1029, 1993, and 8730-2-3.) Although several interviewees noted lamps during the interviews, lamps and lighting fixtures appear in less than 1% of children playing fires.

### **Fuels (Form of Material Ignited)**

*Mattresses and Bedding (current active CPSC project).* A mandatory cigarette ignition flammability standard has been in effect since 1974 (16 CFR 1632), but open flame ignition is not addressed. A 1995 study showed significant involvement of young children in mattress and bedding open flame fires. A CPSC Chairman's Roundtable (1998) led to industry funding of new open flame tests at the National Institute of Science and Technology (NIST). This NIST effort may lead to a voluntary standard addressing open flame ignition. The mattress industry is leading a public education effort to caution the public to the dangers of open flame

ignition of mattresses and bedding. These two items accounted for over 27% of NFIRS child play fires in the home--the largest category by far.

*Blankets.* ASTM issued a new voluntary standard in the early 70s to address small open flame ignitions (ASTM Standard D4151-92). Before the standard, a number of blanketing materials failed flammability testing. Manufacturers complied with the standard by eliminating textile fibers that readily ignited. Samples of the new materials passed flammability testing and no federal regulations were deemed necessary. The current distribution of fibers for this product is unknown. Bedding (which includes blankets) accounted for nearly 14% of residential child play fires. Bedding was identified by the interviewees as one of the items frequently ignited in juvenile-set fires in the home.

*Apparel (current active CPSC project).* Mandatory flammability standards have been in effect since 1953 and prohibit the sale of fabrics that burn rapidly (16 CFR 1610). To meet the flammability standard, fabric samples must pass a flame spread rate test; products that do not meet the standard are not allowed to be used in apparel, but can be used elsewhere. Numerous violations of the standard have been observed, including sheer cellulose, acetates, and popular raised fiber surface fabrics. Cellulose and acetates are cotton and rayon and include the sheer multi-layered imported skirts recalled several years ago. Raised fiber surface fabrics include sweatshirt material. The standard is being updated to reflect current technology and practices, especially provisions that specify sample laundering procedures. Clothing was frequently mentioned by the interviewees as being ignited. Wearing apparel not on a person ranked fifth in the NFIRS data as the material ignited and accounted for 8% of children playing fires in the home.

*Children's Sleepwear (current active CPSC project)*. Mandatory flammability standards covering children's sleepwear in clothing sizes up to 14 have been in effective since 1972 (sizes 0 to 6X, 16 CFR 1615) and 1975 (sizes 7 to 14, 16 CFR 1616). Fabric samples must pass a self-extinguishment test before the fabric can be used in children's sleepwear. The standard was amended to exempt tight-fitting sleepwear and to exempt garments up to size nine months (1996). This exemption allowed cotton to be used in tight-fitting children's sleepwear without the requirement to pass the flammability test. Technical amendments were issued in 1999 to clarify the definition of tight-fitting sleepwear, specifically where to measure garments to determine fit. The fire and burn communities were successful in efforts to have the Congress mandate that CPSC propose a revocation of these 1996 amendments. Comments were received and evaluated by CPSC on the proposal. In 1999, CPSC voted to maintain the 1996 amendments. This standard has been very successful at virtually eliminating fires involving children's sleepwear. NFIRS does not collect data on children's sleepwear.

*Upholstered Furniture (current active CPSC project)*. CPSC motivated the upholstered furniture industry to introduce a voluntary action program to procure furniture components that were less likely to ignite from cigarettes (Upholstered Furniture Action Council (UFAC) Voluntary Action Program, 1978). This voluntary standard addresses smoldering ignitions. A small open-flame standard is being considered by CPSC but has not been proposed at this time. To assess the impact of the use of flame retardant fabrics for upholstered furniture, including toxicity, Congress has mandated a one-year National Academy of Science (NAS) toxicity study, in conjunction with the Government Accounting Office (GAO) to review the process followed by the CPSC in developing a small open flame standard. The NAS report is

anticipated in early 2000. The GAO has recently (November 1999) issued its evaluation of the *Additional Steps Needed to Assess the Fire Hazards of Upholstered Furniture* criticizing the CPSC hazard assessment. Furniture was noted by the interviewees as often ignited in fire play. Upholstered furniture accounts for about 4% of all children playing fires and 6% of child play fires in the home.

*Carpets and Rugs.* A federal flammability standard has been effect since 1971 (16 CRF 1630). Carpet samples must pass an extent of flame spread test when ignited by flaming carpet pill. Floor coverings ranked ninth in NFIRS residential children playing fires and accounted for 2% of child play fires in the home.

*Gasoline Containers.* Voluntary performance and labeling standards for gasoline containers have been in effect since 1984 (ASTM Standards F852-99e1, F839-83). These standards address structural integrity, leakage, color, etc. They do not address the packaging issue, i.e., child-proofing. Fuel accounted for under 2% of all child play fires in NFIRS but was an area of concern for the interviewees.

## Protective Devices

*Portable Fire Extinguishers (current active CPSC project).* CPSC tests found differences in the extinguishing performance of different portable fire extinguishers. Moreover, CPSC found a need for a voluntary standard to require the testing of kitchen extinguishers with an appropriate flammable liquid. In response, UL is issuing a new requirement for kitchen fire extinguishers to be tested using cooking oil fires.

*Smoke Alarms (current active CPSC project).* Voluntary standards for smoke alarms have been issued by UL and NFPA and as yet, no federal regulations have been found to be

necessary (UL Standards 217, 1730; NFPA 70, 72, 74, 101). As many as 88% of US households currently have smoke alarms.<sup>3</sup> A national coalition project sponsored by CPSC to determine causes of non-working alarms (1991 to 1996) found the lack of power to be the primary problem of non-working alarms.<sup>4,5</sup> This finding highlighted the importance of avoiding unwanted (nuisance) alarms as frequently the power was disconnected in response to a nuisance alarm. CPSC is actively pursuing technology to increase use of working alarms in homes. A variety of smoke alarms are available. A test program is planned to evaluate the relative effectiveness of different types of alarms. In the NFIRS data, over 40% of child play fires had no smoke alarm present; in an additional 20% of child play fires alarms were present but did not operate.

*Residential Sprinklers (current active CPSC project).* Residential sprinklers offer an additional protection from fire. While alarms alert occupants to the presence of fire, they are only detection devices and do not have an effect on extinguishing the fire as sprinklers do. Residential sprinklers are present in only a small fraction of U.S. households (they appear in only about 3% of residential fire incidents reported to NFIRS). UL and NFPA voluntary standards exist for residential sprinklers and are being analyzed by the current CPSC project (UL Standard 1626; NFPA 13, 13D, 13R).

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<sup>3</sup> Smith, C.L. (1993). Smoke Detector Operability Survey: Report on Findings. Washington, DC: U.S. Consumer Product Safety Commission.

<sup>4</sup> Smith, C.L. (1993). Smoke Detector Operability Survey: Report on Findings. Washington, DC: U.S. Consumer Product Safety Commission.

<sup>5</sup> Smith, L.E. (1995). Fire Incident Study: National Smoke Detector Project. Washington, DC: U.S. Consumer Product Safety Commission.

## POTENTIAL PRODUCT SAFETY ENHANCEMENTS AND PRODUCT STRATEGIES

Available national data, data from various juvenile fire-setting programs, and anecdotal data indicates that, in the aggregate, matches are the predominant ignition source for fireplay. Lighters are also a significant ignition source. As such, many of the potential product enhancements that were identified either in research materials, interviews, or study team discussions address matches and lighters. Often overlooked in previous studies and literature, however, is changing the flammable qualities of the material ignited in fireplay such as mattresses, bedding, paper products, and clothing. This section addresses these options and makes suggestions for potential product safety enhancements in these areas.

The last area addressed in this section is the result of a common and recurring theme from the interviews: that of fire alarms and fire sprinklers. While these products are not directly involved with the fireplay activity as are the ignition source and material ignited, every fire professional interviewed stressed the need for these devices as a means to save lives and property. Enhancements to these products and strategies to encourage their use are discussed.

From the interviewees' perspectives the first goal is to make matches and lighters more difficult to operate and obtain. Making these products more difficult to operate also has the potential to pose difficulties to adults who are legitimate users of these products. The second goal is to make as many items as possible flame-resistant. This goal may prove to be the more challenging, as the number of items to address may be quite large. Paper and cellulose products, for example, surround us in our daily lives. Certainly, making them flame-resistant would be useful but perhaps unrealistic.

Each of the potential enhancements has some negative aspect, either a detrimental effect on the normal adult use of the product (the task needing to be accomplished becomes more difficult which, for some older adults, may be unacceptable), or a yet-to-be solved technical aspect. These aspects should not be considered as drawbacks, but rather, challenges to overcome. As with child-resistant safety caps, the option could exist that households without children may be able to purchase non-child-resistant products.

### Improved Matches

*Short Duration Match (flame retardant area).* One attractive aspect of matches is watching the flame dance down the match stem; significantly reducing the flame duration may reduce a child's interest in lighting the match. Only 3 to 5 seconds of flame duration is needed for lighting cigarettes, gas appliances, and fireplace fires.<sup>6</sup> The concept is to either impregnate the match stem with a fire retardant or otherwise modify the stem material. These products supposedly are available but perhaps not widely distributed. (The study team could not locate any product like this.) Limiting burn time could potentially shift the market towards lighters. This enhancement should only be implemented along with a parallel enhancement for a shortened flame duration for lighters. This enhancement is discussed in the "Improved Child-resistant Lighters" section below.

*Two-step Match.* A two-step process requires both dexterity and extra time. This concept prevents the quick lighting that may be attractive to children. The matches can either have a coating that must be removed before striking (requiring two separate actions) or the match head requires a separate catalyst or other component added (rubbed onto) before striking.

*Match "Sticks."* Much like disposable cold compresses, disposable hand warmers, or children's lightsticks, a match "stick" would be a thin tube of two reactive materials that when mixed by the force of bending the tube would emit a small, short duration flame. Dexterity is required to snap the stick in the correct manner and strength is necessary to snap it with the required force. As with most of the suggested enhancements to matches and lighters, these requirements may also prove difficult to some adults.

*"Flame-resistant" Match.* One interviewee (Gamache) said that the best match would be one that did not burn well. The technical literature suggests two variations on this concept. The first concept requires that the match stem material be somewhat flame-resistant to produce a feeble flame. The match would need to be held inverted to prolong the life of the flame by increasing the amount of fuel available. When dropped or held incorrectly, the flame would extinguish. This concept was successfully manufactured sometime ago; it is unknown whether this product is still available (*Colite Fire Pruf* match). The second concept is to modify the match head and stem material to burn at a lower temperature. This would inhibit ignition of non-ordinary combustible materials (i.e., plastic toys or treated upholstery) by the flame of the match head but would allow ignition of smoking materials.

*Separate Striker.* This match design requires that the striking surface be separate from the matchbook or matchbox. Either the striking surface can be supplied separately and applied by the consumer or kept separately. Matches cannot be lit without the striker, thus making unopened matches virtually unavailable to children. Opened matches with the striker available would still be available if the responsible care provider does not remove them.

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<sup>6</sup> National Bureau of Standards. (1972). Design concepts for safer matches and lighters (NTIS No. COM-

*Hygroscopic Material.* Hygroscopic materials absorb water. Match heads that are treated with a small amount of hygroscopic material and left out would become unusable after a short period of time. The functional time period for these matches is dependent on the hygroscopic material used and the local relative humidity. These matches would need to be stored in a dry, airtight container. This concept achieves two objectives: matches left accessible cannot be lit after some period of time and to keep the match useable, they must be stored in a container which may prove in itself to be a deterrent to the child.

*Altering the Match Material Weight.* Modifying the match stem material to produce a less stiff match requires more dexterity to light the match. It is very difficult to strike a lightweight match without breaking or otherwise rendering the match unusable before striking. This enhancement may frustrate many adults as well.

### **Improved Child-resistant Lighters**

*Non-removable Child-resistant Protection.* Most child-resistant lighters operate via either a shield over the spark wheel, slide lock, a click-in, push-up feature and/or a mechanism that requires strength or dexterity. And, some children or adults who have dexterity and good fine motor skills seem to be able to remove some of these protections with a little ingenuity. One of the interviewees (from NFPA) noted that NFPA has found that lighters are available with the child-resistant features disabled and that these altered child-resistant lighters can be easily purchased at flea markets. Mr. Michael Bogumill of the CPSC Office of Compliance confirmed that CPSC enforcement staff are aware of deliberate attempts by some manufacturers, wholesalers, and retailers to bypass child-resistant lighter regulations. Mr. Bogumill stated that

the enforcement staff sees many instances where cigarette lighters that fall under child-resistant regulations are on the market with child-resistant features deliberately disabled. According to Mr. Bogumill, when the CPSC enforcement staff encounter these violations, they vigorously pursue the offenders.

The enhancement, therefore, is to require that child-resistant lighters have non-removable protections. The current standard could be amended to require a non-disabling provision.

*Removing Novelty Lighters.* Perhaps the most common “enhancement” to lighters suggested by the interviewees was to remove (ban) novelty lighters, even child-resistant novelty lighters, from the market. Attractiveness and curiosity were the primary issues that concerned the individuals who suggested this option. It was felt that novelty lighters could be so engaging to a child (of any age) that the urge to investigate the lighter and then “figure out how it works” was too enticing.

*Size/Shape.* The small size of cigarette lighters makes them easily held by small hands. An enhancement that enlarges the size of the lighter or is ergonomically more comfortable for larger hands may provide a measure of deterrence. Making the size of the lighter less attractive can also involve changing the location(s) of the spark wheel and gas control lever to increase the distance between them or the angle of use. In the case of utility lighters, the size and shape of the lighter resembles that of a toy gun. Several interviewees suggested enhancements that change this configuration. These enhancements include removing the “pistol grip” to make the lighter less gun-like and shaping the handle with finger grips that were spaced for adult-sized hands.

*Simultaneous Operation.* This enhancement, currently on the market, requires the user to make two distinct hand actions at the same time to light the lighter. An example of a

simultaneous operation is to hold down a lever or push in a button while simultaneously operating the spark wheel. This action may be challenging or difficult for some children to coordinate as well as some adults with limited dexterity or hand strength. The enhancement is to make the simultaneous action one that can only be performed by larger (adult) hands.

*Sequential Actions.* This concept requires a series of actions that must be completed in the proper order and time sequence for the lighter to start. For example, to ignite the lighter, the user would need to tilt the lighter back and forth several times to get a dose of fuel from the storage compartment, strike the lighter on a firm surface (the heel of a hand) to engage the spark wheel, and then operate the spark wheel. If the user waits too long after the first step, the fuel returns to the fuel compartment and the process must be repeated. A variation on this is a two-step (rather than three-step) operation.

*Two Hand Operation.* This product enhancement follows from the observation that children may compensate for a one-handed adult action by using two hands. The concept is to make a product that requires the use of both hands for adults that cannot be compensated for by children. An example is to have a gas release valve lever on the bottom of the lighter that would need to be manipulated with one hand with the other hand operates the spark wheel. The drawback to this design is the inconvenience to bona fide users. It is awkward and the object to be ignited cannot be held while the lighter is in operation. This problem may be minimized if two hands are required to start the flame, but only one is necessary to maintain the flame once it is lit.

*Constant Pressure.* In this design, the lighter flame is maintained by retaining a grip on the lighter. If the grip is relaxed, the flame is extinguished. This may pose problems for some

older users, as well as children, as the hand or finger strength required may exceed their comfort or capability.

*Flame Maintenance.* Flame maintenance addresses the amount of effort needed to keep a flame lit once ignited. This approach does not address the ability of the child to activate the lighter, but rather the child's ability to maintain a flame after the initial ignition. If a flame is difficult to maintain, children engaged in fireplay would be less able to bring the flame to the material to be ignited and keep it in contact long enough to ignite a fire. While this approach does not provide the protection that preventing the lighter ignition does, it however does impede the ability to start a fire.

*Short Flame Duration.* This enhancement is a variation on flame maintenance and in parallel to the short duration match concept addressed earlier. The approach is to limit the amount of fuel available to the lighter to limit the burn time. As with short duration matches, this enhancement should only be implemented along with a short duration match to preclude the market from shifting from a short duration to a longer duration open flame product.

*Flame Protection (Shield/Screen).* In a similar vein, covering the flame with a protective shield or screen will not prevent the lighter from creating a flame. But covering the flame with a shield or screen would prevent direct contact with the material to be ignited. It may also reduce the attractiveness of the lighter as the flame might be visually obscured. This option, however, may in effect eliminate much of the basic utility of the lighter.

*Audible Alarms.* This enhancement would require that an audible alarm sound each time the lighter is successfully engaged. While the sound could be annoying to adult users and

potentially attractive to children, the tone could be an indication to observant care providers that the lighter was in use and perhaps encourage the care provider to investigate the sound.

*Non-flame Lighter.* This new lighter would operate much like a car lighter. The lighter would require a source of current (battery or electric) and would produce a heated, recessed surface that could be used to light cigarettes only. The engaging mechanism, (similar to the push-in automobile models) would need child resistant features to inhibit children from accessing it. The casing would need to be non-heat transferable as this type of lighter would remain hot for a period of time and, as a consequence, would have the potential to scorch or burn. An audible tone could be incorporated into the jacket so that an alarm would sound if the lighter was removed for longer than a specified period of time. This lighter style most likely would not be a pocket lighter, but a small appliance.

### **Limiting Access to Matches and Lighters**

*Placement of Product in Stores.* Another recurring theme in the interviews was the placement of matches and lighters in stores. While the child who is engaged in curiosity fireplay may not seek out matches and lighters in a retail store (but will use what is accessible at home), the child who is more deliberate in his fireplay may. The sense from the interviews was that having matches available at the checkout counters for the convenience of cigarette purchasers also made the matches convenient and accessible for fire-setters. A book of matches is generally free. And if the counter is unattended, the matches are very available. One interviewee (Kolko) suggested that this was one of the easiest ways to acquire matches outside the home. Likewise, conveniently displaying lighters in aisles or near the checkout counter also makes them convenient for children. While children aged 12 or under do not generally make store purchases,

the interviewees suggested that the easy visibility of these products sends a message of acceptance. Interviewees suggested that both matches and lighters be kept behind the registers at the checkout counter along with the cigarettes. In this manner, matches and lighters are not accessible and the message is that, like cigarettes, they are not for children.

*Regulating Access to Minors.* Regulating the sale or access of matches and cigarette lighters to minors is the extension of the discussion of limiting the access of these products to children. Several of the interviewees felt that the sale of matches and lighters should be regulated and not be sold to minors (Rea, Gross). With the idea in mind that matches and cigarette lighters are primarily designed for lighting tobacco products, they should not only be kept with tobacco products (kept behind the counter or under lock and key), they should be not be accessible in retail stores nor available for sale to minors. One interviewee noted that the issue is age-appropriate sales. The interviewee (Gross) maintained that matches are not age-appropriate for minors and certainly not age-appropriate for children under 13. It was noted that local jurisdictions have been able to limit the purchase of aerosol spray paint cans to minors. Whether or not this suggestion can be implemented on a federal level, the interviewees felt that local ordinances might be equally effective.

*Limiting Access in the Home.* The overarching problem noted by the interviewees was access to matches and lighters in the home. One interviewee (Porth) maintained that the biggest concern was parents' use of matches and lighters. Analysis of his data showed that two-thirds of the children in his data set had a smoker at home, ensuring the availability and accessibility of these ignition sources. It is difficult, if not impossible, to require that matches and lighters be

kept out of reach of children. However, interviewees suggested that adults need to be educated on the problem through public safety messages and public awareness campaigns.

## **Mattresses**

*Underbed Covering.* This enhancement is the result of several anecdotal stories from the interviewees. A child uses a lighter or match to look under the bed and ignites any number of items under the bed, to include the bed's undercovering. A child ignites paper or other combustibles in a "safe" container (a dish or ashtray) and pushes the evidence under the bed. An errant paper ember floats up and ignites the undercovering. While not indicated as a significant source of fires, these anecdotes do indicate a need for flame-retardant coverings on the undersurface (dust covering) of mattresses. CPSC's draft small open flame upholstered furniture standard addresses this feature for upholstered furniture; this enhancement to mattresses is a logical extension.

*Mattresses.* Open flame ignition of mattresses is not addressed in the current mattress standard. Mattresses and pillows (along with bedding), however, are the top items first ignited in the NFIRS 1995 to 1997 children playing fire incidents. For children playing fires in structures, they are the leading form of material ignited (see Table 2). Analysis of these fire incidents revealed that over 90% of the mattress and pillow fires were set with small open flames. Of these small open flame ignitions, 93% were from matches and lighters. The recommended enhancement is to require that mattresses be resistant to small open flame ignitions such as those from lighters and matches. A similar enhancement is currently being addressed by CPSC's draft standard for small open flame ignitions of upholstered furniture and is discussed in the previous section "Current Product Safety Enhancements."

## Bedding

Like mattresses, bedding is one of the leading items first ignited in the NFIRS 1995 to 1997 children playing fire incidents. For children playing fires in structures, they are the second leading form of material ignited (see Table 2). Again like mattresses, analysis of these fire incidents revealed that 94% of the mattress and pillow fires were set with small open flames. Of these small open flame ignitions, 91% were from matches and lighters. One of the more evident product enhancements, therefore, is to make children's bedding (sheets, pillowcases, comforters, blankets, and the like) flame-resistant. Currently, the products children sleep in are required to be flame-resistant but the similarly manufactured materials that they sleep on are not.

An extension of this enhancement is to make all bedding flame-resistant. There may be some initial reluctance to purchase flame-resistant sheets for adult use with the currently available processes. There may also be concern about skin reactions, especially the around the face, to the chemicals used in the flame-resistant process. Industry should be encouraged to investigate processes that could be applied to cotton/polyester blends frequently used in sheeting that retain the positive "feel" of sheets and that do not have long-term adverse effects on potentially sensitive skin areas.

## Flame Retardants

Fire results from the combination of fuel, heat, and oxygen. When materials are heated to a high enough temperature, their molecules break down to produce flammable vapors that can chemically react with the oxygen in air. Flame (or fire) retardants help materials resist fire by interfering with these reactions. Several interviewees suggested to "make flame retardant what

can be made fire retardant” (Gross, Gamache, Burns) to include not just mattresses and bedding, but curtains and all upholstered furniture as well.

Many types of flame retardants have been used for many years on many products. The industry is very competitive and new products are continually being introduced, tested, and marketed. Flame retardants help minimize the destruction of various materials by fire. They serve as a protective envelope to many materials. Some flame retardants extend some materials’ flashpoints and increase the time it takes for treated articles to burst into flame. Others often work as a layer protecting a combustible object from brief fire. When exposed to fire, the coating of a fire retardant-treated material bubbles or swells up to form a layer of insulation between the fuel and the heat, preventing the completion of the “fire triangle,” and causing the fire to extinguish itself. Retardants that alter the flammability of materials are applied in a number of ways. For example, textile manufacturers obtain nearly permanent fire resistance in natural and synthetic fabrics used in making carpets, clothing, draperies, and upholstery through processes that molecularly bond retardant compounds to the fabric. While flame retardants slow down the ignition or flame spread of certain materials, they do not make materials “fire-safe.”

*Intumescent Materials.* A combustible surface may be protected against fire by being covered with a special flame-retardant intumescent coating. Upon exposure to fire, an intumescent coating swells up to form a thick layer of insulating foam between the surface (the fuel) and the fire (the heat). The traditional use of intumescent materials has been in fire-retardant paints but a new variation has been developed. Resulting from aviation safety research, new polymers that are more fire-resistant than some of the plastic materials currently used as upholstery and wall coverings in aircraft have been developed. Some of these polymers produce

water vapor and leave a nearly non-flammable residue. The research is conducted at the University of Massachusetts at Amherst in conjunction with the Federal Aviation Administration.<sup>7</sup> These materials are prohibitively expensive at this time and are, as yet, not proven to be feasibly manufactured for general use.

Testing has shown that the new polyhydroxyamide polymer, known as PHA, decomposed when exposed to heat very little in contrast to other polymers. (Polymers do not burn. They decompose from heat and many produce gases that burn.) The PHA that did decompose was converted to water vapor and another nearly non-flammable and stable polymer, PBO.

It is yet to be established if PHAs are useful for applications. According to *Fire Chief* magazine, the Army Material Division has established a program to devise more fire-safe clothing for military uniforms should this program be successful, it is possible that this polymer may find its way into a variety of products.

## Fireworks

Fireworks are the third leading ignition source in NFIRS 1995 to 1997 children playing fire incidents. An enhanced fusing system that incorporates a two-step lighting process might be beneficial in reducing children playing with fireworks fire incidents. A child-resistant safety covering of the fuse would first need to be removed before fuse could be lit. The second option is to severely limit (or ban) the sale of fireworks in general or to minors in specific, which is currently the case in many states. The extension of this is to ban the sale of fireworks all states either via federal statute or by state statute.

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<sup>7</sup> Non-flammable plastic may make safer planes. (1999, August). *Fire Chief*, pp. 26-27.

## Candles

While candles did not frequently appear in child fireplay (according to NFIRS data they account for only 2% of all children playing ignition sources and 4% of residential children playing ignition sources) they account for as many children playing incidents as fireworks in residential settings. Candle fires and deaths continue to increase as they become more popular. Among candle fires, child play is cited in about 9% of these fires and 13% of deaths. NFPA has issued a special report on candle fires. A self-extinguishing candle was proposed as a product redesign by an interviewee (Gamache) along with a candleholder with “childproof” guards to prevent tip-over and to preclude clothing from being caught on fire. Designer or novelty candles are becoming increasingly popular. They are colorful, can be scented, and are frequently placed in bedrooms.

*Short Duration, Self-extinguishing.* Rather than a one-piece wick, these decorative candles could have several short wicks that would require the candle to be relit after a period of time. Or, the wick could be treated to extinguish after burning a specific length and the candle would again need to be relit.

*Long Duration, Self-extinguishing.* Candles could be manufactured so that the wick does not extend to the bottom of the candle. This would cause the candle to self-extinguish shortly before the fire comes into contact with the surface upon which the candle sits. (Data show that many fires are caused when the candle ignites nearby combustibles, such as combustible surfaces or candle holders.)

*Candleholder.* The candleholder (or the candle itself for larger, pillar-type candles) would need to be weighted at the bottom or have a wider bottom base to prevent tip-over.

Candleholders could also be enclosed or, if votive style, with tall sides to reduce clothing ignition. The candle would then need to be lit from a vent on the side.

## **Paper**

Both the interviewees and the NFIRS data suggest that paper products are frequently lit by juvenile fire-setters. As reported earlier, some interviewees suggest that paper is either the actual material initially ignited before the fire spreads to other objects or that paper products are the first items lit in the child's investigation of fire. NFIRS data suggests that paper products in the form trash, magazines, and cartons may be involved in as many as 20% of all children playing fires. While it is technically possible to make cellulose and cellulose products flame-resistant, it becomes an interesting problem in practice because of the wide variety of cellulose products in use. Nonetheless, fire resistant cellulose products is an enhancement that may be beneficial in reducing juvenile-set fires.

## **Flammable/Combustible Liquid "Fuel" Containers**

While fuel accounts for only 1% of all children playing fires in NFIRS, the interviewees noted that it does pose a hazard for young, curious children (no age specified). It was suggested that all flammable/combustible liquids (such as lighter fluid) and subsequent containers (such as portable gasoline cans) be required to have child-resistant caps or packaging.

## **Warning Labels**

Matches, lighters, candles, bedding, and other related materials should carry consumer warning labels notifying the reader that the product has been involved in juvenile-set fires or is a potential fire hazard for children. Moreover, these warnings should be on the products themselves rather than on a wrapper which will be discarded. Research has shown that when a

series of conditions are met, warnings can have some effect in changing behavior and limiting accidents.<sup>8</sup> These conditions reflect an individual who is seeking information and who finds the warning to be consistent with past experience. These conditions also reflect a warning that is present only where and when needed. Even if it may be argued that children may not understand the implications of the warning and that adults may not read or heed the warning label it is, however, a means of bringing the potential problem to the attention of both parties.

### Protective Devices

Although these devices are not directly involved in juvenile-set fires as ignition sources or items ignited, they are life-saving devices that can lessen the effects of any fire, to include those set by children.

*Fire Alarms.* Individuals should continue to be encouraged to check and maintain fire alarms. In the event of a fire, working smoke alarms may mean the difference between life and death. Enhancements to smoke alarms should include better false alarm rates and longer battery lives for non-hardwired alarms. A 1994 CPSC study found that 28% of American households were without the benefit of a working smoke alarm.<sup>9</sup> Individuals should be encouraged to follow new NFPA codes which recommend installing smoke alarms in bedrooms as well.

*Fire Sprinklers.* The use of sprinklers in residential properties is quite low. The National Fire Sprinkler Association estimates that only 1.5% of new homes have sprinkler systems installed. To increase the use of these valuable devices, a tax rebate as well as an insurance premium rebate should be encouraged.

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<sup>8</sup> Ayers, T.J., Gross, M.M., Wood, C.T., Horst, D.P., Beyer, R.R., & Robinson, J.N. (1989). What is a warning and when will it work? Proceedings of the Human Factors Society 33<sup>rd</sup> Annual Meeting, 426-430.

## Evaluation of the Effect of Current Product Improvements

Determining if an enhancement is effective is one of the most difficult areas to address as little data appears to be available. This recommendation is to have more evaluative data collected to provide information that can help determine the effectiveness of the enhancements and strategies. While this area is not a specific product safety enhancement nor a product strategy that can directly effect the incidence of juvenile-set fires, it is a recommendation that if implemented can provide valuable information on what does work and how well it works. For instance, it has been alluded that child-resistant features may have an effect on older children as well as the targeted under age 5 group. What is not known is to what degree older children are protected – is this protection incremental until a particular age or until a particular developmental milestone has been reached? Is there a threshold past which no further protection is achieved or is the protection a gradual decrease as the child ages? These questions and others like them are difficult to answer with the paucity of evaluative data that is currently available. This recommendation seeks to improve the current situation.

## CONCLUSION

The product safety issues discussed in this report reflect the growing concern about juvenile set fires. The sheer numbers of fire incidents that involve juvenile fire play indicate the need for a strategy to reduce the incidence of these fires. The product enhancements and strategies presented here are one of several approaches to reduce the incidence of juvenile set fires.

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<sup>9</sup> Smith, C.L. (1993). Smoke Detector Operability Survey: Report on Findings. Washington, DC: U.S. Consumer Product Safety Commission.

Industry has implemented product enhancements in both items that start fires and for items that often become ignited during a fire. For those products involved with the ignition of a fire, the enhancement is targeted to restricting a child from manipulating the device, whether it is a cigarette lighter, match, or gas-fueled stove. A reasonable balance or compromise must be met though; an adult with mobility or coordination limitations may experience difficulties using a child-resistant lighter. Products cannot be made so safe that adults themselves cannot operate them. A combination of safety enhancements, limiting access of the ignition sources to children, and educating the parents and children about the dangers of fire must be a coordinated effort.

Of those materials that are ignited in juvenile set fires, industry must continue to address the potential for these materials to withstand fire when ignited by a match or a lighter. Flame-resistant sleep-wear for children was a step in the right direction. However, clothes must remain comfortable and affordable for an industry standard to have a profound effect on fire injuries and deaths. Bedding, drapes, upholstery, and the box-springs of beds should also be made fire-resistant to limit the rapid spread of fire. Safety enhancements, such as these, will help to reduce the severity of a fire.

Product enhancements do work. NFPA analyses indicate that fires in the home caused by children playing with matches have declined by approximately 75% since 1980, with half of the decline occurring between 1980 and 1982 (earlier data was unavailable).<sup>10</sup> This coincides with the mandatory standard for the design of matchbooks that became effective in late 1978. The lack of a significant number of fire incidents resulting in injury that involve apparel on children may well be the effect of the children's sleepwear standard. While the CPSC evaluation of the child-

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<sup>10</sup> Hall, J.R. (2000). Children Playing With Fire. Quincy, MA: National Fire Protection Association.

resistant standard has not yet been released, preliminary indications suggest that the incidence of fires set with lighters has decreased in the under 5 age group since the standard took effect.

While this study has focused on products and product safety issues, it is wise to consider the role of education in product safety. Education is not only for juveniles but includes parents and care providers. Regulations can be enacted, laws can be enforced, and products can be enhanced to reduce their roles in fire. But, unless adults understand the consequences of their own behavior and actions concerning matches, lighters, and fire, and how these actions affect the imitative behavior of children, product enhancements will not be as effective. Product enhancements may help reduce the likelihood of a fire starting, but not in preventing the precipitating action.

Safety enhancements for both sources of ignition and items that are ignited can help to reduce many of the juvenile-set fires and the relative severity. However, fires will continue to be set as a result of juveniles. The juvenile fire-setter problem is a complex, national problem. A combination of safety enhancements, fire prevention education, supervision of children, limiting access to fire starting materials, and operational fire detection (and suppression) equipment is needed to fully address the problem of juvenile fire-setting.

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## APPENDIX A

Interview Protocol

### ***JUVENILE FIRE PREVENTION PROGRAM INTERVIEWS***

Total Time: 30 - 45 minutes

#### **A. ADMINISTRATIVE INFORMATION**

|  |
|--|
| Interviewee: _____   |
| Date of Call: _____ Time: _____  |
| Interview status: <input type="checkbox"/> interviewed                 |
| <input type="checkbox"/> interview scheduled (Date: _____ Time: _____) |
| <input type="checkbox"/> declined                                      |
| Interviewer: _____   |

**B. INTERVIEWER IDENTIFICATION**

Time: 2 minutes

Purpose: To identify yourself, your “credentials,” and the reason for the interview.

*“Hello, my name is \_\_\_\_\_. I am working on a project for the National Association of State Fire Marshals concerning juvenile firesetters. The project, under grant from the U.S. Department of Justice, is to investigate products that have been identified as being involved in fires started by juveniles – both as sources of fire ignition and as the flammable item. Your name was recommended to us by \_\_\_\_\_. The interview should take about 30 minutes. Do you have the time now, or would another time be more convenient?”*

If the respondent agrees to be interviewed, proceed to section C and gather the requested information

**OR**

If the respondent declines, note why below and END.

Reason for interview decline:

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## C. PARTICIPANT INFORMATION

Time: 3 minutes

*“Let me clarify some information from you (before we begin OR so that I get back with you”*

|                     |                         |
|---------------------|-------------------------|
| Name and Title:     | _____                   |
| Agency Name:        | _____                   |
| Type of Agency:     | _____                   |
| Mailing<br>Address: | _____<br>_____<br>_____ |
| Phone/Fax/E-mail    | : _____ / _____ / _____ |

Begin interview

***OR***

Establish the date and time for the interview. **Enter the date and time in section A above.**

**If Call Back:** RESUME from section B. Verify section C, and continue at that time.

## D. PARTICIPANT CREDENTIALS

Time: 5 minutes

Purpose: To establish the relevance of the information provided by the interviewee to the project.

### 1. What is your background?: **check all that apply**

- |                          | current                  | past |  |
|--------------------------|--------------------------|------|--|
| <input type="checkbox"/> | <input type="checkbox"/> |      | fire service                                       |
| <input type="checkbox"/> | <input type="checkbox"/> |      | investigator/fire marshal                          |
| <input type="checkbox"/> | <input type="checkbox"/> |      | fire prevention personnel/educator                 |
| <input type="checkbox"/> | <input type="checkbox"/> |      | firesetter program personnel/coordinator           |
| <input type="checkbox"/> | <input type="checkbox"/> |      | youth counselor                                    |
| <input type="checkbox"/> | <input type="checkbox"/> |      | child/adolescent psychologist, etc.                |
| <input type="checkbox"/> | <input type="checkbox"/> |      | fire intervention direct services (specify: _____) |
| <input type="checkbox"/> | <input type="checkbox"/> |      | burn expertise                                     |
| <input type="checkbox"/> | <input type="checkbox"/> |      | policy/research                                    |

Elaborate as necessary, to include responsibilities:

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### 2. What has been your primary experience with juvenile firesetters?

- incident investigation
- child counseling
- family counseling
- guidance clinic
- probation control.
- other \_\_\_\_\_

### 3. How long have you been working with (in the field of...) juvenile firesetters

\_\_\_\_\_

or  other juvenile offenders? \_\_\_\_\_

### 4. In what type of community do you serve?

- urban  regional
- rural  national

suburban

**E. CHARACTERISTICS OF FIRESETTING JUVENILES**

Time: 8 - 10 minutes

Purpose: To establish general observations on the patterns of juvenile firesetter in the interviewees' experience.

1. Approximately what are the ages and genders of juvenile firesetters you typically encounter?

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2. Is there a relationship between age or gender and type of firesetting behavior?  
(curiosity/fireplay, intentional act but not to destroy; intentionally destructive)

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3. What other important characteristics of juvenile firesetters do you see? \_\_\_\_\_

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## F. COMMON SCENARIOS

Time: 10 - 15 minutes

Purpose: To ascertain general conditions that occur in juvenile firesetting incidents.

1. "Who uses what?"

What types of things (products) tend to be used to start juvenile-set fires? This includes inadvertently set fires. \_\_\_\_\_

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Is there a common thread in what age group tends to use which products? \_\_\_\_\_

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---

---

Why did these items tend to be chosen? (use below as prompts if necessary)

easy to use?     easy to acquire?     inexpensive?     other?

---

---

---

How were these items acquired? \_\_\_\_\_

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2. "What gets ignited?"

What types of things (products) tend to be burned (ignited, object first ignited)? \_\_\_\_\_

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Is there a common thread in what age group tends to use which products? \_\_\_\_\_

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Why did these items tend to be chosen? (use below as prompts if necessary)

- easy to use?       easy to acquire?       inexpensive?       other?

---

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How are these items acquired?

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3. Were other items involved, for instance the contents of the trash can was ignited that, in turn, ignited the major fuel load? \_\_\_\_\_

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4. Where do these fires tend to start? (rank, room and area of origin)

rank  
 residential structure: (room of origin/where in room)

\_\_\_\_\_  
 educational/institutional structure: (room of origin/where in room)

\_\_\_\_\_  
 outside: (area of origin/where in area)

\_\_\_\_\_  
 other (area of origin/where in area)

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5. Comment on the intentions of the firesetters as it relates to the products used and the ages of the firesetters

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6. Were accelerants or incendiary devices sometimes used? \_\_\_\_\_

gasoline

other accelerant: \_\_\_\_\_

molotovs

other incendiaries:

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Does their use correlate with the age of the firesetter? \_\_\_\_\_

How were the accelerants or devices acquired? \_\_\_\_\_

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7. If there are changes that could be made to the *ignition sources*, what might these changes be?

the products themselves, such as  design,  material,  size,  function:

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packaging:

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accessibility:

---

attractiveness:

---

warning labels:

---

other:

---

8. If there are changes that could be made to the *objects ignited*, or the other products involved, what might these changes be?

the products themselves, such as  design,  material,  size,  function:

---

packaging:

---

accessibility:

---

attractiveness:

---

warning labels:

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other:

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9. Based on your experience with juvenile-set fires, would life safety devices have helped in preventing fire spread or fire injuries? (e.g., alarms, sprinklers, extinguishers, removable window bars, etc.)

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## **G. WRAP UP**

Time: 1-3 minutes

Purpose: To capture any additional information not collected and develop responses to any issues already discussed

1. What other observations do you have about the items involved in juvenile set fires?
  
  
  
  
  
  
  
  
  
  
2. What other juvenile fire prevention ideas/suggestions do you have? (please be specific)

## **H. THANK YOU**

Please thank the interviewees for their time. Follow up with a letter.

## APPENDIX B

### PRODUCT ENHANCEMENT CANDIDATE INTERVIEWEES

| CANDIDATE   | STATUS      |             |             |
|---|-------------|-------------|-------------|
|   | Interviewed | Unavailable | No response |
| Tim Adams<br>Oklahoma City, OK Fire Department                                      | ✓           |             |             |
| Dave Allmon<br>Columbus, IN Fire Department   |             |             | ✓           |
| Anne Arensberg<br>Bingham Child Guidance Center                                     | ✓           |             |             |
| Daniel Bernardy<br>Minnesota State Fire Marshal's Office                            |             | ✓           |             |
| Beverly Burns<br>Tempe, AZ Fire Department  | ✓           |             |             |
| Dennis Caudle<br>Dunedin, FL Fire Department  |             |             | ✓           |
| Marcel Chappuis Ph.D.<br>Clinical Psychologist                                      | ✓           |             |             |
| Teri Charpentier<br>Juvenile Firesetters Program<br>American Red Cross              |             | ✓           |             |
| Jim Cubbage<br>Assistant State Fire Marshal<br>Delaware State Fire Marshal's Office |             | ✓           |             |
| Joe B. Day<br>Joe B. Day & Associates   | ✓           |             |             |
| Marion Doctor, LCSW<br>Denver, CO Children's Hospital Burn Center                   |             | ✓           |             |
| Battalion Chief George Ellis<br>Annapolis City, MD Fire and Rescue                  |             | ✓           |             |

| CANDIDATE   | STATUS      |             |             |
|---|-------------|-------------|-------------|
|   | Interviewed | Unavailable | No response |
| Jill Eschete<br>Kansas State Fire Marshal's Office  |             |             | ✓           |
| Kenneth Fineman Ph.D.   |             |             | ✓           |
| Captain Bill Folger<br>Prince George's County, MD Fire Department                             | ✓           |             |             |
| Irene M. Gaccek<br>Clearwater, FL Fire Department   |             |             | ✓           |
| Sharon Gamache<br>National Fire Protection Association  | ✓           |             |             |
| Leslie Gaugler<br>Mesa , AZ Fire Department   | ✓           |             |             |
| Captain Chris Gauss<br>Baltimore County, MD Fire Department                                   |             |             | ✓           |
| Jessica Gaynor Ph.D.  |             |             | ✓           |
| Carol Gross<br>Phoenix, AZ Fire Department  | ✓           |             |             |
| Salvatore Guarnieri<br>FDNY Bureau of Fire Investigation<br>Special Operations Command        | ✓           |             |             |
| Lisa Hayes<br>Houston, TX Arson Bureau  |             |             | ✓           |
| Caryl Henderson<br>Firefighters Pacific Burn Institute  |             | ✓           |             |
| Captain Sam Hsu, Fire Marshal<br>Montgomery County, MD Department of Fire and Rescue Services | ✓           |             |             |
| David J. Kolko Ph.D.<br>Western Psychiatric Institute and Clinic                              | ✓           |             |             |
| John Lattomus<br>Delaware State Fire Marshal's Office   |             |             | ✓           |
| Mary Marchone<br>Montgomery County, MD Bureau of Life Safety Services                         | ✓           |             |             |
| Joanne McLaughlin<br>Burn Prevention Foundation   |             |             | ✓           |

| CANDIDATE   | STATUS      |             |             |
|---|-------------|-------------|-------------|
|   | Interviewed | Unavailable | No response |
| Jeff McMahon<br>Fire Investigator<br>Worcester County, MD                                   |             |             | ✓           |
| Joe Meinecke<br>Fire Stoppers   |             |             | ✓           |
| Cappy Meredith<br>Virginia Beach, VA Fire Department  |             | ✓           |             |
| Pat Mieszala<br>Burn Concerns, Inc.   |             | ✓           |             |
| Mary Mondoizzi and<br>Julie Klein RN BSN<br>Children's Hospital Medical Center of Akron, OH |             | ✓           |             |
| Sandy Nygaard<br>Rural Metro Fire Department Scottsdale, AZ                                 |             |             | ✓           |
| Patricia O'Leary<br>Counseling and Support Services   |             |             | ✓           |
| Nathan Peterson<br>Director<br>YOU, Inc. (Youth Opportunities Up)                           | ✓           |             |             |
| Irene Pinsonneault<br>F.I.R.E. Solutions, Inc.  |             |             | ✓           |
| Don Porth<br>Portland, OR Fire Bureau<br>SOS FIRES: Youth Intervention Programs             | ✓           |             |             |
| Marc Proulx<br>Winnipeg, Canada Fire Department   |             |             | ✓           |
| Carol Rea<br>Escondido, CA Fire Department  | ✓           |             |             |
| John Rudisill and Randy Wally<br>Charlotte, NC Fire Department<br>Fire Busters Program      |             |             | ✓           |
| Ricky Scott<br>Columbus, OH Bureau of Fire Prevention                                       | ✓           |             |             |
| Lieutenant Robert Toth<br>Aurora, CO Fire Department  | ✓           |             |             |

| CANDIDATE  | STATUS      |             |             |
|--|-------------|-------------|-------------|
|  | Interviewed | Unavailable | No response |
| Vicki Wade<br>Palm Beach Gardens, FL Fire Department | ✓           |             |             |