Investigation Guideline

Appendix 121
October 2005

CANDLE FIRES AND FIRE HAZARDS

I. INTRODUCTION

The purpose of this investigation is to learn more about the characteristics of the candles that start fires and the circumstances under which candle fires occur. Most candle fires result from a physical malfunction on the part of the candle or from a miscalculation on the part of the user. We are interested in data that capture (1) the physical characteristics of the candle's performance and (2) the user's interaction with the candle. We are interested in anything that is relevant to understanding the cause of the fire.

Please remember that no guideline can cover all the pertinent factors that may apply to a particular incident. Include an explanation of any relevant factors in your narrative, even when these factors have not been specifically mentioned in the guideline.

A. Background Information

Data from the National Candle Association show that the use of candles in the home has increased dramatically over the last 15 years. Not only have candles experienced an increase in popularity, but the types of candles available on the market and their proposed uses have increased at a staggering rate. Candles are no longer intended for use only as interior decorating items, but are now marketed as art items, air cleaners, therapy and meditation devices, fragrance disseminators, and so forth.

Not surprisingly, the number of residential fires attributed to candles has also increased. According to 1999 data[1], there were an estimated 12,800 fire service attended residential fires caused by candles resulting in an estimated 1,530 injuries, 100 deaths, and 265.0 million dollars in property loss. While the number of total residential fires has been steadily decreasing, the number of candle fires has, nonetheless, been steadily increasing.

[1] Miller D, Smith L, and Greene M. (2003), *1999 Residential Fire Loss Estimates*, Bethesda, MD: Directorate for Epidemiology and Health Safety, U.S. Consumer Product Safety Commission.

CPSC staff has worked with the candle manufacturers on an industry standard for candles. The standard completed the ballot process in August 2004. As it stands, the standard addresses issues of flame height, stability, end of life behavior (that the candle burns itself out), and secondary ignition. Also under consideration for adding to the standard are requirements for fuel pool (wax or gel) temperature, ignitable accessories, and holders or containers.

A separate standard for candle accessories, including candle trim rings, tealight burners, and potpourri burners, is expected to be ready for ballot in 2005. Additional fire performance requirements are being developed for gel candles.

B. Product Description

The American Society for Testing and Materials (ASTM) defines a candle as "one or more combustible wicks supported by a material that constitutes a fuel which is solid, semi-solid, or quasi-rigid at room temperature, 68° to 80° F (20 to 27° C); it can also contain additives that are used for color, odor, stability, or to modify the burning characteristics; the combined function of which is to sustain a light-producing flame."[2] Traditionally, a candle is cylindrical, but today's candles come in many fanciful designs and shapes. The current market is producing a vast variety of products that deviate from the traditional concept of a candle. We are interested in all products comprised of wax and/or oil, that are burned with a wick.

Types of Candles:

- **Taper or dinner candle:** Long and thin, varies from 6 to 18 inches in length and can burn up to 12 hours. Usually they are not scented, may be drip-resistant, and produce little smoke or soot. Tapers are available in many colors. (ASTM definition: a slender candle produced to be used with a candle accessory for support.)

- **Freestanding Candle:** ASTM definition: a rigid candle (that is, pillar-shaped, column-shaped, or figurine) recommended to be used on a heat-resistant, nonflammable surface or on a candle accessory.

- **Pillar or column candle:** Thick in diameter. The shorter pillar candles can stand on their own without the assistance of a candle holder/accessory, but should always be used with a candle holder/accessory.

[2] ASTM Standard F1972 – 99, Standard Guide for Terminology Relating to Candles and Associated Accessory Items.

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- **Jumbo Pillars:** These are thick, sturdy, and larger than pillar or column candles. Sometimes called colonnades, these candles have multiple wicks (as many as three to five). They are often scented and can have very long burning times.

- **Votive candles:** Small candles that must be burned in a container since the wax melts at low temperatures and creates a pool of molten wax. Votive candles were originally used for religious or ceremonial purposes. (ASTM definition: a candle produced for use fully within a candle accessory, specifically, a votive holder.)

- **Tealight candle:** Small candles that come in their own metal holders to retain the melted wax. Traditionally used to keep teapots warm, tealights are now used with a variety of products. Potpourri burners are one example. (ASTM definition: a cylindrical filled candle produced with a diameter and height of approximately 1.5 in. (38 mm) and 0.75 in. (19 mm) respectively.)

- **Filled candles:** Decorative and highly scented candles poured into various glass, tin, or pottery pieces, called containers. (ASTM definition: a candle produced and used within the same vessel.)

- **Gel candles:** Some are clear and transparent taper style, while others come in containers. Some gel candles have objects imbedded in the gel, for instance, wood or plastic objects, seashells, or candy. (ASTM definition: a candle where the primary fuel is a liquid, such as mineral oil, terpene type chemicals, or modified hydrocarbons that are not mineral oil based, which may or may not contain organic functional groups; it also contains a chemical agent to increase the viscosity (thicken) to a point where the candle has a quasi-rigid property.)

- **Citronella:** These are scented candles that have oversized wicks to prevent the flame from extinguishing in a breeze. They produce an odor and smoke that deter insects and are for outdoor use only. (The insect repellent quality of citronella candles is regulated by the EPA, but CPSC has jurisdiction over the burning properties of the candle itself).

- **Novelty:** There are many candles that do not fit into the above categories. For instance, wax bead candles; oil and water candles that are similar to oil lanterns in which only the oil/wax substance floats in a bed of water. Candles shaped like objects: cars, mushrooms, etc.; seasonal candles, such as, Halloween candles depicting scary sights; Christmas decoration candles, and so forth also can be classified as novelty candles.

Candle container vs. candle accessory/holder:

- **Candle Containers:** Some candles come in an encasement that is commonly called a "container." Candle containers are made of metal, glass, or plastic and completely cover the bottom and sides of the candle, leaving only the wick and top of the candle exposed.
- **Candle Accessory/Holder:** On the other hand, a candle accessory/holder is something that is placed under, on, or around the candle. Candle accessories/holders come in a variety of shapes and sizes and often have a novelty or decorative function. Accessories include candle trim rings, candle burners, and potpourri burners.

C. Specific Items of Interest

CPSC staff wants to learn as much as possible about the circumstances that led to the fire. In cases involving candle trim rings, candle burners, or potpourri burners, collect the fire candle and identical exemplars from the consumer, when available.

Candle malfunctions should be described in as much detail as possible. "Candle malfunction" encompasses all aspects of the candle's functioning, including the candle holder and the candle container. Candle malfunctions include flare-ups (flames that are excessively tall or large), wax that runs and transfers flame to other objects, candle holders that catch fire, and candle containers shattering or igniting. There are many other ways for candles to malfunction, and the above are a few selected for illustration.

It is essential that we get a full and complete description of the scenario in which the candle fire occurred and any factors that contributed to the fire. We are interested in how much attention was paid to the candle and whether there were people in the room with the candle the entire time. Were the people in another room or some other part of the house when the fire broke out? We are interested in how close the candle was to other things that could catch fire. More precisely, we want to know exactly where the candle was and what other objects were around the candle. Also how close were these objects to the candle?

One of the focuses of this study is charting the course that led to the fire, and especially the degree to which the candle was monitored. How the user interacted with the candle is of interest. Determine whether he/she followed the instructions on the label (if there was one). Describe the environment where the candle was burning. Were there any occupants in the room with the candle when the fire started?

If a candle ignited a mattress/bedding, upholstered furniture, or wall covering, include additional information about these products (see Appendices 15, 19, or 118).

Smoke alarms, fire sprinklers, and fire extinguishers are increasingly present in homes to prevent fire deaths and limit damage. We are interested in learning how well these products perform the jobs for which they were intended. When they were present but not useful, we need to know why they weren't useful, e.g. an inadequate number or placement of smoke alarms, other installation problems, lack of maintenance, failure of the products, unfamiliarity with the products, etc.

D. Headquarters Contacts

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II. INSTRUCTIONS FOR COLLECTING SPECIFIC INFORMATION

A. Synopsis

Write a synopsis of the sequence of events that occurred before, during, and after the fire. Specify the source of the ignition, the products involved, the extent of damage, and the nature of all injuries and deaths.

B. Description of the Incident Environment

PRE-INCIDENT: Describe the home/residence where the candle fire occurred.

Describe the sequence of events that led up to the fire. Describe the course of activities immediately before the candle was lighted and the course of events immediately before the fire broke out. Include the candle's placement in the environment, the room the candle was in, and how close the candle was to the nearest object or material (if on a shelf, how close to the next shelf, etc.).

Also include the reason the candle was in use, for instance, used as a light source, used as a therapy, or used for decorative/ambience reasons.

INCIDENT: Describe the cause of the candle fire. Determine exactly what happened to precipitate the fire. Describe the way the fire unfolded.

- Did anyone witness the fire event? Was anyone in the room with the candle when the fire started? Did anyone enter the room when the fire was already in progress?

- Was the candle involved in an accident, for example: candle dropped or knocked over, person or draft transferred flame to other objects and materials, etc.?

- Was a child or children playing with the candle and started the fire? If so, include the ages of the children. Was there adult supervision? How was the candle lit?

- Once the fire began, did the user try to extinguish the fire? If so, how successful was the attempt? What means did he/she use to extinguish the fire? Was the fire department called? Did the fire department respond? If so, what was the extent of the fire department's involvement?

- Was there a smoke alarm present? Did smoke reach the alarm? Did it signal? How early in the fire? Did it contribute to the recognition of the fire? If alarm failed to signal, identify the alarm. Was there a sprinkler system present? Did it operate? If it failed to operate, identify the system. Did the occupant use a fire extinguisher? If so and it was unsuccessful, describe problem.

POST-INCIDENT: Describe any damage done to the area where the candle was located, e.g., burn marks, scorched top, blistered top, etc.

- Recount who was injured and how badly. Did anyone require hospital care? Was anyone permanently injured? Did anyone die?

- How severe was the property damage and loss? Please provide an estimated dollar value for destroyed or damaged property and possessions and the source of the estimate.

C. Description of Interaction between User or Injured Person(s) and Product

- Did the candle have a label with instructions for use?
- If so, what can the user remember about the label?

- Did the user follow the instructions commonly given on the label about the proper use of the candle, for instance:
  - trim the wick,
  - keep the candle out of a draft,
  - not let the candle burn for more than four consecutive hours, and
  - not let the candle burn lower than ½ inch?
- Was a match stem or any wick debris left in the candle after it was lighted?
- Determine the degree to which the candle was monitored.
  - Where were the people in relation to the candle?
  - Was anyone within sight of the candle?
  - What was going on at the time of the fire?
- Describe any other people in the vicinity. What were they doing before the fire?
- If no one was monitoring the candle, was it because the user assumed
  - the candle would burn safely,
  - candle's surroundings were safe,
  - there was no perceived danger, or
  - simply forgot.
- If the candle was monitored when the fire broke out, explain the circumstances surrounding the incident.

D. Description of User and Injured Persons

- Please record the age, sex, and general health of the user and injured persons.

- Briefly describe the length and type of treatments the injuries required and whether any permanent injuries were incurred.

E. Description of Product

(Full description of the physical candle taken on the data record sheet.)

- Was the candle part of a decoration? If so, please describe the decoration. What other materials were part of the decoration?

- How did the household use the candle? Describe use patterns and characteristics.

- If a multiwick candle had the wicks migrated closer to each other or farther apart from each other as the candle burned? Did wick or wicks migrate closer to holder?

- Describe the surface the candle was placed on (even if candle was in a holder). For instance, was it a kitchen countertop, wooden shelf, ceramic bath fixture, glass shelf, dining room table, coffee table, end table, on top of television, on top of magazines, etc.?

- Did the user notice any unusual characteristics of the way the candle burned? For instance, was the flame excessively high (greater than two inches)?

- If the user did not notice any irregular burning characteristics, did the candle function properly, did it burn cleanly and smoothly?

- Was the candle in a candle holder when purchased? If so, did the candle holder malfunction in any way (e.g. paint or surface coating ignite; candle holder overheat and ignite other materials; etc.)? If so, at what point in the fire sequence? What were the dimensions of the candle holder (i.e. type/size of base, length, etc.)? Was the holder stable?

- Was the candle holder sold with the candle as one item?

- If the candle was in a container (i.e., the encasement that the candle was manufactured in), did something happen to the container that contributed to the fire?

F. Product Safety Standards

At present, there is a voluntary standard in place for Cautionary Labeling as well as a fire safety voluntary standard that addresses requirements for flame height, stability, end of life behavior, and secondary ignition.

A separate standard for candle accessories is expected to be ready for ballot in 2005. Additional fire performance requirements are being developed for gel candles.

III. PHOTOGRAPHS /DIAGRAMS OF INCIDENT SCENE

If the user still has the candle remnant, conduct an on-site investigation. Obtain photographs of the candle and the area surrounding the candle. If the user took pictures or videotapes of the candle while it was malfunctioning, obtain copies of those pictures or videotapes. Diagram the room where the candle was being used, if possible.

IV. OBTAINING SAMPLES AND DOCUMENTS RELATED TO THE INVESTIGATION

Collect the remaining part of the candle and/or accessory if the incident involved a trim ring, candle burner, potpourri burner, or some other atypical accessory. Also, collect an identical exemplar if possible. Obtain copies of the fire incident report and any other investigative reports of the incident.

If the candle ignited a mattress or bedding, or upholstered furniture, complete the appropriate data record sheet for those products (Appendix 15 or Appendix 19).

V. CORONER'S REPORT AND DEATH CERTIFICATE

In cases that involve a death or deaths, procure the coroner's report and the death certificate.

DATA RECORD SHEET FOR CANDLE FIRES

1. Task number _____
2. Date of fire _____
3. What is the age of the user?
   - < 10 ? ☐
   - 10 – 14 ? ☐
   - 15 – 19 ? ☐
   - 20 – 64 ? ☐
   - 65 – 74 ? ☐
   - 75+ ? ☐
   - Unknown ? ☐

4. Type of candle; describe the candle and its size in a few words:
   a. taper: length _____ diameter _____
   b. pillar or column: length _____ diameter _____
   c. votive or tealights: describe candle size and the holder _____
   _____
   d. novelty candle: describe both candle and container/jar _____
   _____
   e. filled candle: describe both candle and container/jar _____
   _____
   f. gel: _____
   g: other: _____

5. Characteristics of the candle (may have multiple characteristics), describe in a few words:
   a. brand _____
   b. scent _____
   c. hand-made _____
   d. oil & water _____
   e. spirals _____
   f. beeswax _____
   g. made from wax beads _____
   h. citronella _____
   i. color _____
   j. single or multiwicks, give number of wicks _____
   k. shape _____
   l. decorative objects embedded in candle _____
   m. decorative objects embedded around candle _____
   n. gel _____
   o. regular "wax" candle _____
   p. other, specify _____

6. Was the bottom of the wick anchored with a metal tab? _____

7. Did the wick migrate (move from its original position)? _____

8. Was the candle in a candle holder? _____
If yes, did it come with the candle or was it provided separately by the consumer?
_____

Describe the candle holder (metal, wood, glass, plastic, decorative, plate, ceramic, resin, etc.). _____

9. Aside from a holder, was the candle used in conjunction with any candle accessories? ____
_____

10. Do you remember whether the candle had a label? _____
If yes, what did it say? (If label available, get pictures.) _____
_____

11. Where was the candle purchased? _____

12. What is the name and manufacturer of the candle? _____

13. What did the candle cost? _____

14. Was the candle part of a set that included other items? Describe: _____
_____

15. After the candle was acquired, how long before it was first used by the household? _____
_____

16. Was this the first time the candle had been used? _____

17. How long had the candle been burning when this incident occurred? _____

18. Did the candle burn all the way down? _____

19. When using the candle, did you notice that it:
a. flared up? _____
b. produced excessive smoke? _____
c. produced a sooty residue? _____
d. showed signs of uneven burning? _____

20. Did some part of the candle, other than the wick, ignite (object or material in wax; paint or color on outside of candle)?
_____

21. Did the candle burn smoothly and cleanly? _____

22. What caught fire first? _____

23. What other items, near the candle, ignited? _____

24. What did the user do to try to extinguish the fire? _____
_____

25. Did any spilled wax catch fire, or spread the fire? _____

26. If anything near the candle ignited, what was the distance from the candle to the ignitable(s)? _____

27. In what room was the candle being used? _____

28. Was the candle located in a draft or in front of an open window? _____

29. On what surface was the candle placed (e.g. coffee table, TV, kitchen counter)? _____
_____

30. For what purpose was the candle being used (e.g. ambiance, light, fragrance, religion)? __
_____

31. Was there a smoke alarm in the home? _____
    a. If yes, where was the alarm closest to the fire? _____
    b. Did it sound an alarm? _____
    c. Was there enough smoke at the alarm that it should have operated? _____
    d. Did it contribute to the recognition of the fire? _____

32. Was there a sprinkler system in the home? _____

33. How often did you or anyone in the household burn candles (give total for entire household)?
    a. daily [ ]
    b. once a week or more [ ]
    c. once a month or more [ ]
    d. only at special or holiday occasions [ ]
    e. never [ ]