UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MD 20814

This document has been electronically approved and signed.

Date: December 7, 2011

BALLOT VOTE SHEET

TO : The Commission
Todd A. Stevenson, Secretary

THROUGH: Kenneth R. Hinson, Executive Director

FROM : Cheryl A. Falvey, General Counsel
Philip L. Chao, Assistant General Counsel, RAD
Patricia M. Pollitzer, Attorney

SUBJECT : Firepots, and Gel Fuel: Advance Notice of Proposed Rulemaking

BALLOT VOTE DATE: December 13, 2011

Staff is forwarding to the Commission a briefing package recommending that the Commission issue an advance notice of proposed rulemaking ("ANPR"), addressing the risk of injury associated with firepots and gel fuel. A draft *Federal Register* notice is provided for your consideration.

Please indicate your vote on the following options.

I. Approve publication in the *Federal Register* of the draft ANPR, without changes.

_____ _____
Signature Date

II. Approve publication in the *Federal Register* of the draft ANPR, with changes (please specify changes):

_____

_____

_____

_____ _____
Signature Date

CPSC Hotline: 1-800-638-CPSC(2772) H CPSC's Web Site: http://www.cpsc.gov
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III. Do not approve publication in the *Federal Register* of the draft ANPR.

_____ _____
Signature Date

IV. Take other action (please specify):

_____

_____

_____

_____ _____
Signature Date

Attachment: Staff's Briefing Package on Firepots and Gel Fuel

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Staff Briefing Package on Firepots and Gel Fuel

December 7, 2011

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EXECUTIVE SUMMARY

This briefing package addresses the question of whether the Commission should issue an advance notice of proposed rulemaking (ANPR) to initiate a rulemaking proceeding that could result in a rule establishing labeling or performance standards for firepots and gel fuels or banning them.

Firepots are relatively new, small portable decorative lighting products marketed for outdoor and indoor use. They typically consist of a "firepot" or base that is usually a ceramic or heat-resistant material, a metal "burn cup" that holds the gel fuel, and a snuffer tool, which is used to extinguish the flame. Firepots use gel fuel that produces an aesthetically appealing clean-burning flame with no visible smoke or ash. The gel fuels intended for use with firepots are sold mostly in bottles/containers. As of September 30, 2011, staff is aware of 76 incidents that resulted in 2 deaths and 86 injuries involving firepots using gel fuel. The two fatalities and most of the injuries were severe burns that required hospitalization.

These deaths and injuries prompted investigations by the CPSC's Office of Compliance and Field Operations into various firepot and gel fuel products. CPSC staff obtained voluntary recall agreements from 12 firms, recalling more than 2 million bottles of pourable gel fuel.

Preliminary testing and evaluation of firepots and gel fuels show that they pose a serious risk of burn injuries to consumers due to firepot design features, the burning and physical characteristics of the gel fuel, and gel fuel container packaging. Currently, staff is not aware of any voluntary or mandatory safety standards that directly address the risk of injury to consumers from firepots and gel fuels.

Among the options available to the Commission are issuing a rule specifying performance requirements for firepots and gel fuel to reduce the risk of injury identified with these products. Staff would develop these performance requirements based on analysis of incident data, laboratory testing, and product technical evaluations. To issue such a rule, the Commission would need to assess the costs and benefits of the performance requirements.

Staff recommends that the Commission vote to approve publication of an ANPR in the *Federal Register* that initiates a rulemaking proceeding, which could result in a rule establishing labeling or performance standards for firepots and gel fuels or banning them if no standard that would adequately protect the public is feasible.

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BRIEFING MEMORANDUM

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
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Memorandum

DATE: December 7, 2011

TO: The Commission
Todd A. Stevenson, Secretary

THROUGH: Cheryl A. Falvey, General Counsel
Kenneth R. Hinson, Executive Director
Jay Howell, Deputy Executive Director for Safety Operations

FROM: J. DeWane Ray, Assistant Executive Director
Office of Hazard Identification and Reduction
Rohit Khanna, Project Manager
Office of Hazard Identification and Reduction

SUBJECT: Staff Briefing Package for ANPR on Firepots and Gel Fuel

I. ISSUE

This briefing package addresses the question of whether the Commission should issue an advance notice of proposed rulemaking (ANPR) that would begin a rulemaking proceeding to address hazards associated with firepots using gel fuels. Such a rulemaking could result in a rule establishing standards or bans for firepots and gel fuels.

II. BACKGROUND

Firepots[1] are relatively new, small portable decorative lighting accents marketed for outdoor and indoor use. They typically consist of a pot or base that is usually a ceramic or heat resistant material (Figure 1), a "burn cup" (Figure 2) that is usually a stainless steel or ceramic cup that holds the gel fuel, and a snuffer tool (Figure 3), that is used to extinguish the flame.

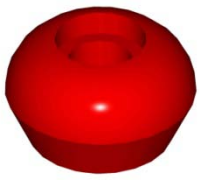

Figure 1 - Pot or Base

Figure 2 – Burn Cup

Figure 3 - Snuffer

[1] Throughout this memo, the term "firepot" is used to refer to firepot products that use a gel fuel, also sometimes called "personal fireplaces," "fire gel bowls," and "table top fire pits."

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Firepots are intended to be used with gel fuel that produces an aesthetically appealing, clean-burning flame with no visible smoke or ash. The gel fuels intended for use with firepots are mostly sold in bottles/containers ("pourable" gel fuel) (Figure 4); however, firepot gel fuel is also available in single-use cans (Figure 5).

Figure 4 – Pourable Gel Fuel Bottle

Figure 5 – Single-Use Can

Single-use cans of gel fuel can only be used with those firepots that have sufficient space in the firepot's burn cup to hold the fuel can. As of September 30, 2011, staff is aware of 76 incidents that resulted in two deaths and 86 injuries involving firepots using gel fuel. The 2 fatalities and a majority of the injuries resulted in severe burns that required hospitalization. The most common hazard scenario involves *refueling.*[2] There are several other hazard scenarios in the remainder of the incident reports, including: explosions during use (not related to refueling); ejections of the firepot's burn cup; and firepot tip over, among other scenarios.

As a result of an investigation by the Office of Compliance and Field Operations (Compliance) and various safety assessments conducted by the Office of Hazard Identification and Reduction (Hazard Reduction), staff has determined that certain firepots used with gel fuel present severe fire and burn hazards to consumers. Acting expeditiously to prevent consumers from being exposed to fire and burn hazards, Compliance staff requested manufacturers/importers of gel fuel to participate in an industry-wide voluntary recall. As of December 7, 2011, 12 voluntary recalls have been announced, covering more than 2 million bottles of pourable gel fuel containers (Tab A).

As staff becomes aware of new products using gel fuel that may present a substantial risk of injury, Compliance will pursue, and Hazard Reduction will support, efforts to obtain voluntary corrective actions. In the meantime, the Commission may consider more comprehensive strategies to address the hazard posed by firepots using gel fuels. The following discussion summarizes technical analyses of the incident data, severity and health consequences of the injuries, the use characteristics and risk factors, and the design factors and chemical properties of firepots and gel fuel. The discussion also includes a summary of market information. The memorandum concludes with a discussion of options available to the Commission to reduce the risk of fatalities and severe burn injuries associated with firepots used with gel fuels.

[2] *Refueling*–when the consumer adds additional gel fuel to the firepot either knowingly or unknowingly in the presence of flame.

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III. DISCUSSION

A. Summary of the Incident Data

Staff identified firepots used with gel fuel as an emerging hazard in June 2011, after a severe injury was reported to the CPSC. The Directorate for Epidemiology, Division of Hazard Analysis (EPHA), provided information on the reported incidents associated with firepots used with gel fuel (Tab B). As of September 30, 2011, staff is aware of 76 incidents resulting in two fatalities and 86 injuries. Forty-eight of the 86 (56 percent) injury victims were hospitalized. Many of the 38 victims who were not hospitalized received treatment in emergency rooms. Listed below are classifications of the hazard patterns identified among the 76 total fatal and nonfatal incident reports:

- **Refueling:** Forty-nine incidents (64 percent) involved consumers refueling a firepot that exploded when the flame in the firepot ignited the vapors in the fuel container. These 49 incidents caused 2 fatalities and 61 injuries, 35 of which were high-severity burns to victims requiring hospitalization. In many cases, the most seriously injured victim was not involved in the refueling process.

- **Explosion while lighting:** Five incidents (about 7 percent) caused 9 injuries, 4 of which were high-severity burn injuries needing hospitalization. In these scenarios, the incident reports stated that the firepot already had fuel, and an explosion occurred when the consumer attempted to light the firepot with an open-flame ignition source (*i.e.,* lighter).

- **Fuel container explosion:** Two incidents (about 3 percent) caused explosions in which both victims were hospitalized, one with high-severity burn injuries. In this scenario, the incident reports stated that the fuel container exploded after it was placed some distance away from the firepot. Engineering analysis of these incidents suggests that it was likely that a small flame was present in the burn cup during refueling of the firepot, which could have ignited the flammable vapors in the fuel container.

- **Burn cup ejection:** Six incidents (about 8 percent) caused 3 injuries in which one victim was hospitalized. In these scenarios, the incident reports stated that the burn cup spontaneously ejected from the firepot during use. This scenario could not be replicated in laboratory testing; however, staff has not discounted the validity of these reports. Staff theorizes that burn cup ejections may be caused by excessive pressure buildup from inadequate venting in the interior of the firepot.

- **Explosion during use:** Four incidents (about 5 percent) caused 3 injuries in which one victim, a 5-year-old boy, was hospitalized with high-severity burn injuries. In these scenarios, the incident reports stated that fuel in the burn cup exploded during use. This scenario could not be replicated in laboratory testing; however, staff has not discounted the validity of these reports. Staff theorizes that the cause of fuel explosions may be due to exposure to contaminants.

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- **Tip over:** Three incidents (about 4 percent) caused 6 injuries in which 4 victims were hospitalized with high-severity burn injuries. Two of the victims were young children. In these scenarios, the firepot was either bumped or accidentally knocked over, causing the burning gel fuel to spill onto the victims.

- **Firepot base breakage:** Three incidents (about 4 percent) reported the firepot base broke during use. One incident reported that when the firepot's base broke, ceramic shards went flying. These incidents did not result in injury. This scenario was also not observed in staff laboratory testing; however, staff has not discounted the validity of these reports. It is possible that the temperature and internal pressure generated during firepot use and the durability of the base material from normal use and abuse may cause breakage of the base.

- **Explosion while snuffing flame:** There was one incident report where an explosion occurred while the consumer was snuffing out the flame. This incident did not result in injury. This scenario was also not observed in staff laboratory testing; however, staff has not discounted the validity of this report.

- **Not enough information:** There were three incidents resulting in three injuries, one requiring hospitalization, where not enough information was available to classify the hazard pattern.

Some incidents have been reported with gel fuel in other products, such as fireplaces. At this time, staff has not seen a similar level of incidents reported with these products.

B. Severity and Consequences of Burn Injuries Resulting from Firepots Using Gel Fuel Burn Injuries

The Directorate for Health Sciences (HS) provided information on the severity and health effects of burn injuries, healing duration required, and the medical interventions for the clinical management of such injuries (Tab C). Burn injury severity is dependent on several factors, including the victim's age, burn depth, the percent total body surface area (TBSA) having second and third degree burns, and the location of the burn. Certain areas of the body are considered critical[3] with respect to determining burn severity.

The incident data show that firepots used with gel fuel present a risk of serious burn injuries to consumers of any age. The injury severity of reported incidents ranged from minor to high-severity burns. Two victims died from burn injuries sustained from firepot refueling. The victim's upper body is often exposed to flaming gel fuel, and the resulting injuries can be extensive and life threatening. Some surviving victims of firepot incidents have required life-support and many required medical treatment in intensive care units and/or specialized burn treatment centers. Where detailed information on medical treatment of high severity burn injuries was available, typically victims were admitted to hospitals for a period of 10 to 76 days. Eleven victims had burns involving 20 to 70 percent TBSA. The medical intervention for high

[3] Face, ears, hands, feet, joints, genitals, and perineum are considered critical areas.

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severity burns is long, painful, and complicated, often involving multiple surgeries. Victims can die after receiving high severity burn injuries due to complications including shock, fluid loss, and infection. Two victims in firepot refueling incidents died 4 and 33 days after being burned from complications of their injuries. In addition to long term physiological effects on victims, these types of injuries may cause long lasting emotional trauma.

C. Staff Technical Assessments of Firepots and Gel Fuels

CPSC staff conducted technical assessments of characteristics of firepots and of gel fuel properties and packaging that contribute to risk of burn hazards to consumers. These assessments included evaluating firepot design features, gel fuel burning and physical properties, gel fuel chemical composition, gel fuel container properties, warnings and labels on firepots and gel fuels, and relevant human factors issues. Based on these evaluations, staff has considered regulatory options to address safety hazards presented by firepots and gel fuels.

A memorandum from the Directorate for Laboratory Sciences, Engineering Division (LSE) describes the characteristics of firepots and flammability properties of gel fuel. This section summarizes LSE's assessment (Tab D).

Firepot Design Hazards

Open cup burning, lack of fuel containment, stability

Firepots produce a fairly large flame in an open cup burn configuration with a gel fuel (Figure 6). Firepots require the addition of fuel directly over where a flame can be present, which presents an explosion hazard (Figure 7).

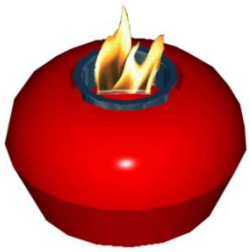

Figure 6 – Open Cup Burning

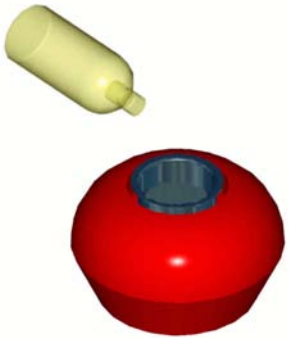

Figure 7 – Fuel Filled Over Flame Location

This combination of burner design and fuel is more dangerous than other decorative lighting products. Unlike candles, oil lamps, and torches with wicks, firepots do not need a wick to sustain a flame. When a lit firepot is tipped or knocked over, the burner configuration has no means of containing the burning gel fuel to keep it from spreading on people and nearby combustibles. Firepot bases are made in a variety of shapes and sizes and taller and narrower firepot bases are more likely to be tipped or knocked over. Tip over/spill testing under several scenarios was conducted to observe the distance and pattern of fuel spillage. When firepots

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placed on a flat surface were tipped, fuel was ejected up to 5 feet. When firepots were positioned on heights simulating placement on a table or bar, as reported in the incident data, firepot falls from a height of 31 inches splattered fuel approximately 5 feet; firepot falls from a height of 42 inches splattered fuel about 9 feet. Staff is aware of 3 firepot tip-over incidents that injured 6 victims and required hospitalization of 4 victims.

Burn cup ejection

Typically, the firepot's burn cup is a stainless steel or ceramic container that holds the gel fuel. Burn cups range in size from about 2.5 to 3 inches in diameter and about 3 inches in depth. They are placed in the firepot and are not secured to the base by any means (Figure 8).

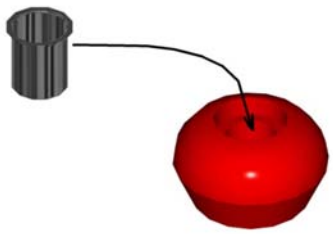

Figure 8 – Burn Cup Placement in Firepot – No Securing Mechanism

Staff is aware of 6 burn cup ejection incidents injuring 3 victims, one requiring hospitalization. Although this scenario was not observed in laboratory testing, a possible explanation of this scenario is that high temperatures achieved during use could build up pressure inside the base. This pressure buildup combined with inadequate venting may cause the burn cup to be ejected.

Gel Fuel Burning and Physical Properties

Flame Luminosity

Gel fuels produce efficient clean-burning flames with very little smoke or soot generation due to the high concentration of alcohol. This property produces a flame with much less visible light as compared to similar-sized flames from other types of fuels. This makes flames produced from gel fuels difficult to see, especially in daylight or in situations where ambient lighting is bright. As the flame burns the gel fuel in the burn cup, the flames become more obscured in the bottom of the cup. There is often a small flame or smoldering combustion of the spent gel fuel in the base of the burn cup when the fuel is almost exhausted. This can mislead consumers into thinking the firepot's flame is out and needs more fuel. If the consumer adds fuel to the firepot when there is a small flame or smoldering combustion in the burn cup, the gel fuel can ignite easily.

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Gel Fuel Viscosity and Fire Behavior

Gel fuels are thicker and have higher viscosities than liquid fuels. This high viscosity contributes to an increased severity of burn injuries. Most of the incidents involve burning gel fuel contacting victims when either an explosion, ejection of the burn cup, or a firepot tip over occurs. When burning viscous gel fuel contacts skin or clothing, the flaming gel fuel sticks more readily than liquid. The fire safety technique known as "Stop, drop, and roll" is ineffective because patting the flaming gel fuel can spread the burning surface. Although the high viscosity of gel fuel limits the area of spillage and reduces pool fire risk,[4] the gelling agent makes it difficult to extinguish the fire. Use of water in this type of fire is ineffective and increases the fire risk, by spreading burning gel over a larger surface area.

Gel Fuel Chemical Composition

The Directorate for Laboratory Sciences, Division of Chemistry (LSC) analyzed 18 samples of firepot gel fuels to determine chemical composition, viscosity, and flashpoint (Tab E). The analyses showed that the firepot gel fuels primarily are alcohol based (approximately 80 percent). The types of alcohol included ethanol, isopropanol (IPA), and ethanol and IPA mixtures. The gel fuels' remaining components generally were water, gelling agents, and additives, including citronella and eucalyptus. The gel fuel viscosities ranged from 5,000 to 25,000 CentiPoise (cP).[5] The flashpoint was determined to be less than or equal to 74 °F, with the lowest measure of 32 °F.[6] The flashpoint is the temperature at and above which a material gives off enough flammable vapor to form a mixture with air that can be ignited by contact with an ignition source such as a spark, or flame. In general, the lower the flash point, the greater the fire hazard the material presents. Flash point should not be confused with auto-ignition point temperature at which combustion occurs spontaneously, without an external source of ignition.

Gel Fuel Container Hazards

The Directorate for Engineering Sciences, Division of Combustion and Fire Sciences (ESFS) provided an assessment of gel fuel containers and described how the combination of the fuel and the properties of the fuel containers contribute to the risk of fire injury (Tab F). The most commonly reported hazard is an explosion resulting from refueling the firepot with gel fuel. Staff is aware of 49 incidents causing 2 fatalities and 61 injuries, 35 of which were high severity burns needing hospitalization. Through analysis of incidents, gel fuel flammability limits, gel fuel container design, and laboratory testing, staff identified and validated firepot refueling scenarios.

[4] Pool fire – a fire involving a liquid phase combustible fuel.
[5] For perspective, water has a viscosity of 1 cP, and honey is ~10,000 cP.
[6] This sample contained butane.

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Gel Fuel Classification and Flammability Limits

Firepot gel fuels are considered to be flammable under the Federal Hazardous Substance Act (FHSA) because they have a flashpoint above 20° F and below 100° F. 16 C.F.R. § 1500.3 (c)(6) (ii). In addition, under the National Fire Protection Association (NFPA) classification system, firepot gel fuel would have a Class 1B designation. This classification is the same as gasoline and charcoal lighter fluid. The Flammability Limit is the concentration of fuel gases in a mixture, between which limits this mixture is flammable. The Lower Flammable Limit (LFL) is the leanest mixture that still sustains a flame, and the Upper Flammable Limit (UFL) is the richest flammable mixture.

Gel Fuel Container Headspace Analysis and Refueling Explosion Phenomena

The container headspace is the volume above the liquid/gel fuel level in the container. The headspace volume is inversely proportional to the amount of fuel in a container. Gel fuel in a container produces headspace vapors that are flammable at room temperature and over a broad range of commonly encountered ambient temperatures, unlike gasoline that is so volatile at most ambient temperatures that the headspace vapors are actually too rich to burn. The explosive concentration of vapors in gel fuel containers poses a significant fire and explosion hazard if the headspace vapors come in contact with a flame.

The firepot refueling incidents report an explosion and subsequent ejection of burning gel fuel occurring during the process of adding gel fuel to the firepot. These phenomena have been demonstrated in laboratory testing. When there is enough headspace and sufficient fuel remaining in the container, bringing the container in a position so a flame comes in contact with the headspace will ignite the explosive mixture. The resulting ignition of the explosive mixture causes an increase of pressure inside the fuel container and can cause the remaining gel fuel to eject from the bottle while igniting the fuel as it exits the throat of the container.

Lack of Safety Features in Gel Fuel Containers

Most firepot gel fuel containers are open-mouth containers, similar to water bottles or larger containers used to store cleaning liquids. These containers are not provided with safety features commensurate with the level of hazard presented by the fuel, particularly the presence of flammable headspace in gel fuel containers. Flammable liquid containers typically employ safety features, such as ground, venting, and flame arrestors, to prevent the ignition of flammable vapors during foreseeable use of the fuel. In support of Compliance activity on gel fuel bottle recalls, staff conducted performance evaluations of possible corrective actions to reduce the potential for firepot refueling incidents, focusing on modifications to the gel fuel containers. Several prototype modifications were submitted for technical evaluation. Most of the modifications were to the container caps and were aimed at reducing the container throat opening area. ESFS staff developed four performance criteria during the course of corrective action evaluations. These are:

1. *Any safety feature must be permanently attached to the container so that the consumer cannot reasonably remove it;*
2. *There must be a mechanism to prevent hot gases and/or flames from coming in contact with and igniting the explosive atmosphere in the container headspace;*

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3. *Any safety feature must be robust and continue to function at the end of the foreseeable worst-case life time of the container; and,*
4. *Any container safety feature must not impede the function of the product, such that the consumer would likely remove or otherwise bypass the safety feature.*

These criteria developed by staff for evaluating potential corrective actions could be used as part of a performance standard to address the safety hazards of gel fuel containers used in firepots.

Firepot and Gel Fuel Characteristics, Use Patterns, and Risk of Injury

The Directorate for Engineering Sciences, Division of Human Factors (ESHF) provided an assessment of the product, use patterns, and factors that contribute to the risks of injuries with firepots and gel fuels (Tab G). The focus of the ESHF analysis was the characteristics of firepot and gel fuels as they relate to the most common firepot refueling incidents. In this analysis, ESHF examined 12 firepot samples and 12 gel fuel container samples.

Warnings and Instructions Assessment

Most of the firepot and gel fuel containers had some kind of warning associated with refueling firepots. None of the warnings on firepots were permanent; so after the packaging and instructions are thrown away, there are no reminders during future use. There are refueling warnings on gel fuel containers. However, they lack conspicuity because they get lost in the myriad of other warnings on the container. In general, the warnings on firepots and gel fuel containers are ineffective.

Perceived Hazardousness

Firepots appear to be simple to use, decorative accessories. Most firepots and gel fuels are marketed for indoor and outdoor use; the gel fuel containers use phrases such as "environmentally friendly," "eco-friendly," "live safe and burn safe"; and the fuel is commonly packaged in containers that look similar to plastic like water bottles. These packaging characteristics do not convey effectively the serious fire and burn risks firepots and gel fuel present and may reduce the likelihood of consumers paying attention to the list of warnings.

Product Familiarity

Firepots may look familiar to consumers who have experience safely operating similar products, such as a candle placed in a pot (candle pot). Consumers may assume a similar level of risk for firepots, and therefore, they might completely disregard the warnings, thinking they understand the risks firepots pose.

Flame Visibility

A crucial characteristic of firepots using gel fuel is the flame visibility. The clean burning flame produced by gel fuel, combined with the consumer's line of sight relative to the burn cup, as well as the ambient lighting, create a hidden hazard that can make it nearly impossible to see the presence of a flame. In 26 firepot refilling incidents, consumers reported

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that the flame was not present; whereas, it was more likely that the flame was present but it was difficult to see.

D. Market Information and Economic Considerations

The Directorate Economic Analysis (EC) completed an analysis of firepot and gel fuel market information (Tab H).

Firepot Market Information

Firepots using gel fuels are relatively new products introduced to the consumer market in significant quantities within the last 2 years. Typically, these products have been sold through retailers of home and garden goods, including major chains, and online retailers. Firepot retail prices range from about $20 to more than $100; most are priced between $20 and $40. At least 11 firms are known to have manufactured or marketed firepots. Most of these firms also have marketed their own brands of gel fuel. The leading firms in the firepot market have fewer than 20 employees, and they are categorized primarily as wholesalers. These firms are considered small businesses under size standards developed by the U.S. Small Business Administration (SBA). Staff estimates nearly 2.5 million firepots could have been sold to consumers, with most of them likely purchased in 2010, and during the first six months of 2011.

Gel Fuel Market Information

Gel fuels have been sold in sizes ranging from one pint to one gallon, with one-quart containers being the most common size. Individual containers of gel fuel typically range in price from $5 to $20 per container. Some gel fuels are also sold in single-use cans that are intended for use in firepots or "personal fireplaces." These single-use cans range in size from about 3 to 7 ounces. Unlike firepots that recently have been introduced into the consumer market, gel fuels have been available for a longer time period for use with fireplaces specifically designed for this fuel. Gel fuels for fireplaces have been available in single-use cans since the mid 1980s. In 2011, 12 firms selling gel fuel for use with firepots agreed to voluntary recalls of their products totaling more than 2 million units. All of the firms that sell gel fuel have fewer than 50 employees and are categorized as wholesalers. These firms are considered small businesses under size standards of the SBA.

E. Existing Relevant Standards

Staff is not aware of any existing standards that directly address the hazards firepots and gel fuels pose to consumers. The National Fire Protection Association (NFPA) 30: Flammable and Combustible Liquids Code covers the storage, handling, and use of flammable and combustible liquids. This code contains a provision prohibiting the use of Class I liquids (gel fuels) outside closed systems where they can come in contact with open-flame or other ignition sources. Transportation of flammable and combustible liquids is subject to the Department of Transportation (DOT) regulations. Neither NFPA 30, nor DOT regulations contain requirements that would address the safety hazards identified by staff from the incident data.

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IV. REGULATORY AND OTHER ALTERNATIVES

One or more of the following alternatives could be used to reduce the identified risks associated with firepots using gel fuel:

1. ***Mandatory rule.*** The Commission could issue a rule under the Consumer Product Safety Act (CPSA) establishing performance requirements for firepots and gel fuels to prevent or reduce an unreasonable risk of injury associated with these products.

2. ***Labeling rule.*** The Commission could issue a rule under the CPSA establishing requirements for warnings or instructions for firepots and gel fuels to prevent or reduce an unreasonable risk of injury associated with these products.

3. ***Voluntary standard.*** If a voluntary standard exists that adequately addresses the risk and there is substantial conformance to the standard, then the Commission could defer to the voluntary standard instead of issuing a mandatory rule.

4. ***Reliance on recalls.*** The Commission has obtained voluntary recalls from certain gel fuel firms. The Commission could continue to rely on recalls, both voluntary and mandatory instead of a mandatory rule.

5. ***Ban.*** The Commission could issue a rule banning firepots and gel fuels if no feasible standard exists that would adequately reduce the risk of injury associated with these products.

V. DISCUSSION OF ALTERNATIVES

Require a Warning Label

The Commission could rely on warnings. However, in order for a label to be effective, consumers must notice, read, and understand it, and comply with it 100 percent of the time when using the product. Several factors influence compliance with warnings and instructions, such as consumers' familiarity with the product, how severe they perceive the consequences of the hazard, and the conspicuity of the warning. ESHF concluded that additional or improved warnings and instructions will have a limited effect on addressing the risk of injury associated with firepots and gel fuels.

Rely on Recalls

The Commission could rely on recalls. Staff is concerned that reliance on recalls would be an ineffective approach to ensuring that hazardous firepots used with gel fuel remain out of the market. Recalls provide coverage only for products that have already been distributed. To initiate recalls on firepots and gel fuels, staff has to establish independently that each firepot and gel fuel in question presents a substantial product hazard. In addition, a recall of an individual manufacturer's firepot or gel fuel has no binding effect on other manufacturers who may have similar products that present the same hazard.

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Firepots and gel fuels are relatively easy and inexpensive products to manufacture and have minimal barriers to market entry. Therefore, it is easy for a firm to enter and exit the market. This makes it difficult for staff to monitor the marketplace for firepots and gel fuels that may pose a safety risk to consumers.

Defer to a Voluntary Standard

The Commission could defer to a voluntary standard; however, staff is not aware of any consensus-based voluntary or international standard that addresses the described risk of injury. Nor is staff aware that any group is in the process of developing such a voluntary standard. If a voluntary standard were developed for firepots or gel fuel, staff would need to assess the effectiveness of the standard in reducing the risk of injury. This would include an assessment of the adequacy of the provisions in the standard and an evaluation of the likelihood that manufacturers would conform to the standard.

Issue a Mandatory Rule that Sets Performance Requirements for Firepots and Gel Fuels

The Commission could issue a rule specifying performance requirements for firepots and gel fuel to reduce the risk of injury identified with these products. For example, to address the tip-over risk with firepots, one option may be a standard that sets requirements for stability and/or performance tests for gel fuel containment. In addition, performance requirements could be developed for flame visibility, to increase consumer awareness of the presence of a flame. To address the refueling hazard, one option may be a standard that sets requirements for the gel fuel containers to prevent ignition of the flammable headspace or to require venting of the container. To issue such standards, the Commission would need to assess the costs and benefits of the performance requirements.

Issue a Ban of Firepots and/or Gel Fuel

The Commission could issue a rule banning firepots and/or gel fuel. To issue such a rule, the Commission would need to determine that there is no feasible standard that would adequately protect the public. In addition, the Commission would need to assess the costs and benefits of banning either or both of the products.

VI. RECOMMENDATION

Staff recommends that the Commission approve publication of an ANPR in the *Federal Register* that initiates a rulemaking proceeding that could result in a rule establishing labeling or performance standards for firepots and gel fuels or banning them if no standard that would adequately protect the public is feasible.

The Office of the General Counsel (OGC) prepared a draft ANPR that would commence a rulemaking proceeding under the Consumer Product Safety Act for firepots and gel fuels. The draft ANPR discusses the products, the risk of injury, and regulatory alternatives to address the risk of injury. The draft ANPR also solicits written comments from interested persons.

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TAB A: Gel Fuel Recall Information

TAB A

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

Memorandum

Date: November 4, 2011

TO : Rohit Khanna, Project Manager,
Office of Hazard Identification and Reduction

THROUGH :
Andrew Kameros, Assistant Executive Director,
Office of Compliance and Field Operations

Marc Schoem, Deputy Director,
Office of Compliance and Field Operations
Acting Director, Defect Investigations Division

Blake Rose, Lead Compliance Officer,
Electrical & Fire Hazards Team
Office of Compliance and Field Operations

FROM : Joseph Williams, Compliance Officer,
Defect Investigations Division
Office of Compliance and Field Operations

SUBJECT : Compliance Actions on Pourable Gel Fuels

The Office of Compliance and Field Operations recently initiated several recalls involving pourable alcohol gel fuel. To date, 12 voluntary recalls have been announced, recalling more than 2 million bottles of pourable gel fuel. Of those, six firms had incidents involving burn injuries. As of September 1, 2011 (date of the collective industry announcement, Release #11-315[7]), the Commission was aware of 65 incidents involving 37 burn injuries and two fatalities. These 65 incidents occurred over the past couple of years as the product was introduced to U.S. markets.

The products involved in the recalls were alcohol-based gel fuels in pourable containers (containers intended to be used to refill an open flame appliance). Additionally, each recalled product was marketed for use with firepots. It was clear to Commission staff and to the industry that there were safety risks in the delivery system (the method of pouring the gel fuel into the open flame appliance) that needed to be resolved immediately and resulted in these recalls. The recalls noted in Release #11-315 state the hazard as:

"The pourable gel fuel can ignite unexpectedly and splatter onto people and objects nearby when it is poured into a firepot that is still burning. This hazard can occur if the consumer does not see the flame or

[7] http://www.cpsc.gov/CPSCPUB/PREREL/prhtml11/11315.html

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is not aware that the firepot is still ignited. Gel fuel that splatters and ignites can pose fire and burn risks to consumers that can be fatal."

The recalled gel fuels originated with both domestic and international manufacturers. The recalled gel fuel products that the Commission has announced to date include:

Bird Brain (Release #12-002)
Bond Manufacturing (Release #11-336)
Evergreen Enterprises (Release #12-020)
Fuel Barons, Inc. (Release #11-337)
Lamplight Farms, Inc. (See Industry Release #11-346)
Luminosities/ Windflame (Release #11-340)
Marshall Group (Release #12-007)
Napa Home & Garden (Release #11-255)
Pacific Décor, Ltd. (Release #11-344)
Real Flame, Inc. (Release #11-338)
Smart Solar, Inc. (Release #11-339)
SunJel Company (See Industry Release #11-315)

No safety standards (mandatory or consensus-based voluntary standards) exist addressing the fuel and/or fuel containers used with firepots. The industry is seeking and developing design modifications to improve the safety of these products. Previously, CPSC Engineering Sciences staff provided performance criteria to the industry that staff would use to evaluate any proposed retrofit of the gel fuel bottles in any proposed corrective action.

However, the singular approach of retrofitting the gel fuel bottles for the corrective action, would not address all the hazard patterns that staff has identified in its analysis of the incident reports. As a result, no gel fuel bottle retrofit has been accepted in any corrective action plan at this time, pending further review.

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TAB B: Firepot and Gel Fuel Hazard Data

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

Memorandum

Date: November 4, 2011

TO: Rohit Khanna, Project Manager
Office of Hazard Identification and Reduction

THROUGH: Kathleen Stralka, Associate Executive Director
Directorate for Epidemiology

Stephen Hanway, Director, Division of Hazard Analysis
Directorate for Epidemiology

FROM: David Miller, Mathematical Statistician, Division of Hazard Analysis
Directorate for Epidemiology

SUBJECT: Firepot and Gel Fuel Incident Data as of September 30, 2011

Objective: To provide details about the numbers of incidents involving firepots and gel fuels and their resulting casualties. This memorandum also provides details about the different hazard scenarios that led to these incidents.

Background: As a result of a severe injury incident involving firepots and gel fuel reported to the U.S. Consumer Product Safety Commission (CPSC), staff identified the combination of these products as a possible emerging hazard in June 2011. CPSC staff began monitoring reported incidents to learn about the extent and the nature of the hazard presented by these products to help inform possible mitigation strategies.

On September 1, 2011, the CPSC announced a recall of pourable gel fuel from nine different manufacturers. CPSC staff continues to compile and characterize cases as incident reports are received. The earliest incident that is known to staff occurred on April 3, 2010, and the most recent occurred on September 1, 2011. The most recent search of CPSC databases provided any case reported to CPSC by September 30, 2011. In some cases, the incident is reported to the CPSC days after it occurred, and in other cases, it has taken more than a year. Several incidents that occurred in 2010 were reported to CPSC in 2011.

Incident Data: A majority of the reported incidents (as well as a majority of the injuries and both of the fatalities) occurred when a consumer was pouring more fuel (refueling) into a firepot. This resulted in an explosion. There are several other hazard scenarios that comprise the remainder of the incidents including: explosions during use (not while refueling); ejection of the firepot's burn cup; firepot tip-over, as well as other scenarios.

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The incidents involve two deaths and 86 injuries. The two fatal victims were a 51-year-old man and an 84-year-old woman. A majority of the injuries are severe burns that required hospitalization. Of the 86 nonfatal injury victims, 19 were to victims of unknown age. Among the 67 injury victims whose ages are known, one was under five; seven were between the ages of five and 14; 12 were between the ages of 15 and 29; 39 were victims between the ages of 30 and 49; seven were victims between the ages of 50 and 64; and one was over age 64.

Table 1 details all of the incidents by the type of hazard scenario and also provides information about the number of injuries and deaths. It also gives information about the number of injury victims whose injuries were serious enough to require hospitalization. Below are some key facts that can be found in Table 1:

- CPSC is aware of a total of 76 incidents that resulted in 86 injuries and two fatalities. Most (53) of the incidents involved one victim, but nine had no injuries and 14 had multiple victims.

- Many of the injuries were severe. Forty-eight of the 86 (56%) injury victims were known to have been hospitalized for their injuries. Many of the victims who were not hospitalized received treatment in emergency rooms for their burn injuries.

- Forty-nine of the 76 incidents (64%) that CPSC has knowledge of occurred when a consumer refueled a firepot. These 49 incidents resulted in 61 of the 86 injuries and both of the fatalities.

- There were five incidents where there was an explosion when a consumer was attempting to light a firepot. These incidents resulted in nine injuries.

- There were three incidents where the firepot tipped over while in use, and this led to six injuries.

- There were six incidents where the metal fuel container was ejected from the firepot. This led to three injuries.

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Table 1. Reported Firepot Incidents and Gel Fuel Incidents (Full Year 2010 and 2011 through September 30) by Hazard Scenario

Scenario[8]	Incidents	Injury Victims[9]	Hospitalized Injury Victims[10]	Deaths
Refueling firepot (pouring fuel/immediately post-pouring)	49	61	35	2
While actually lighting fuel (after filling or refilling firepot)	5	9	4	0
Firepot Tip over	3	6	4	0
Metal burn cup ejected spontaneously while in use	6	3	1	0
Explosion of fuel in burn cup while in use	4	3	1	0
Fuel storage container exploded (delayed, not while pouring fuel)	2	2	2	0
Firepot broke spontaneously while in use	3	0	0	0
Explosion while snuffing	1	0	0	0
Limited Details (preclude classification scenario)	3	2	1	0
Total	**76**	**86**	**48[11]**	**2**

Tables 2 and 3 give similar information to Table 1, but they are broken down by the year that the incident occurred. Table 2 provides information about the 2010 incidents, and Table 3 does this for the 2011 incidents. Below are some facts worth noting about the year-by-year breakdown in Tables 2 and 3:

- Fifty-nine of the 76 incidents (78%) occurred in 2011, while the remainder occurred in 2010.

- All three of the *tip-over* incidents occurred in 2010, while all six of the *ejection of burn cup* incidents occurred in 2011.

[8] For hazard scenario descriptions, see: "An evaluation of reported incidents involving use of firepots and gel fuel with regard to burn injury patterns, and the severity and likelihood of injury," S. Inkster, CPSC Health Sciences, November 2011.
[9] Excluding fatalities.
[10] Excluding fatalities.
[11] Forty-eight of the victims were known to be hospitalized. In addition, there were several injury victims where it is not clear whether they were hospitalized. In these cases, they are not counted as being hospitalized.

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Table 2.Reported 2010 Incidents

Scenario	Incidents	Injury Victims	Hospitalized Injury Victims	Deaths
Refueling firepot (pouring fuel/immediately post-pouring)	10	11	8	0
Firepot tip-over	3	6	4	0
While actually lighting fuel (after filling or refilling firepot)	1	2	1	0
Firepot broke spontaneously while in use	2	0	0	0
Limited Details (preclude classification scenario)	1	0	0	0
Total	**17**[12]	**19**	**13**	**0**

Table 3. Reported 2011 Incidents (Through September 30)

Scenario	Incidents	Injury Victims[13]	Hospitalized Injury Victims[14]	Deaths
Refueling firepot (pouring fuel/immediately post-pouring)	39	50	27	2
While actually lighting fuel (after filling or refilling firepot)	4	7	3	0
Metal burn cup ejected spontaneously while in use	6	3	1	0
Explosion of fuel in burn cup while in use	4	3	1	0
Fuel storage container exploded (delayed, not while pouring fuel)	2	2	2	0
Firepot broke spontaneously while in use	1	0	0	0
Explosion while snuffing	1	0	0	0
Limited Details (preclude classification scenario)	2	2	1	0
Total	**59**	**67**	**35**	**2**

[12] Of the 17 incidents that occurred in 2010, eight were reported to CPSC in 2011.
[13] Excluding fatalities.
[14] Excluding fatalities.

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TAB C: Firepot and Gel Fuel Health Consequences

TAB C

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

Memorandum

Date: November 28, 2011

TO : Rohit Khanna; Project Manager,
Office of Hazard Identification and Reduction

THROUGH : Mary Ann Danello, Ph.D., Associate Executive Director,
Directorate for Health Sciences

Lori E. Saltzman, M.S., Division Director
Directorate for Health Sciences

FROM : Sandra E. Inkster, Ph.D., Pharmacologist
Directorate for Health Sciences

SUBJECT : An evaluation of reported incidents involving use of firepots and gel fuel with regard to burn injury patterns, and the severity and likelihood of injury

I. Objective

Firepots are a type of refillable, decorative, table top illumination product, featuring a wickless, open flame. Recently, firepots have become popular with consumers. A typical firepot consists of a ceramic vase housing a removable fuel reservoir, known as the "burn cup." Fuels recommended for use with firepots are alcohol-based gel formulations. This memorandum provides an evaluation of the reported incident scenarios involving use of alcohol-based gel fuels in firepots, with regard to burn injury patterns and severity and likelihood of injury.

II. Incident Scenario Analysis

As of September 30, 2011, Hazard Analysis (HA) staff had identified 76 firepot and gel fuel incidents. Staff reviewed all incident reports to classify them by the most likely incident scenarios based on the available information. Health Sciences (HS) staff and HA staff jointly classified the number of victims and their injury severity on the basis of whether the victims were reportedly hospitalized or not (Miller, 2011). HS staff further reviewed incident data with regard to the number of victims per incident, specific body parts involved, and severity of burns. Notably, 67 of the 76 incidents (88 percent) resulted in reported burn injuries; and at least 14 incidents are known to involve multiple victims.

The summary data for incidents reported up to September 30, 2011, is detailed in Table 1. It should be noted that details were limited for several reports, so these represent minimum counts. Furthermore, multiple incident reports lacked medical documentation/verification of injuries; so,

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in these cases, HS staff's assessment of injury specifics is based on consumer or media reports, and those could change if further information becomes available.

1. Refueling/Refilling

The majority of incidents, the majority of high severity injuries, and both deaths reported, occurred in situations where consumers were attempting to refill a firepot that had been in use during or immediately before refilling. In 49 incidents consumers reported that they were in the process of, or had just finished, pouring the fuel when sudden unexpected fuel ignition or explosion occurred. The reports generally stated that victims and/or nearby surfaces and furnishings were "splattered," "sprayed," or "doused" with ignited gel fuel. Multiple incidents described a victim(s) being hit by a "ball of fire." Some reports were not clear about whether it was the fuel in the firepot, the stream of fuel being poured, or the fuel in the plastic fuel storage container that actually ignited and/or exploded. In refueling scenarios, many consumers reported that they believed the firepot had run out of fuel because flames were not evident (26 of 49 refueling incidents), but some (6 of 49 refueling incidents) do acknowledge that a low flame was present in the near-empty firepot.

Some details of the two fatal refilling incidents, in which the victims died several days after being hospitalized, are noted below.

On May 28, 2011, a 51-year-old man sustained greater than 60 percent total body surface area (TBSA[15]) burns and died after being hospitalized for 33 days; his 47-year-old wife was also hospitalized for serious burns. The incident involved a partially full, gallon fuel container. Information contained in the CPSC investigation report notes: "His wife was sitting at the table as he was pouring the fuel. Suddenly there was an explosion and the husband, wife, lanai, plants, clothing. etc., were all on fire. It was literally "raining fire" as flaming globs of fuel gel were dripping from the top of the lanai onto the victims and patio. Exact details of how the jug exploded and threw fuel gel as far as 30 feet away to a patio chair at the far end of the lanai was uncertain" (IDI 110701CNE0001).

On July 3, 2011, an 84-year-old woman was hospitalized, and then died four days after sustaining greater than 40 percent TBSA burns. According to the news report, a witness gave the following description of the incident: "The light low in their firepot, the victim added more gel fuel, and then instantly—an explosion. She had rolled on the ground for a while, but that wasn't doing anything," he said. "The gel was just rubbing all over her body and creating more fire." The wicker seats and plastic table where she was sitting were consumed—as well as her. "When her clothes lit on fire, it was full-fledged. She was burned from her chin all the way down, all of her arms." In this incident it is acknowledged that the victim attempted to refill a near-empty firepot still known to have a flame (IPII X1170893A).

The Engineering Sciences (ES) and Laboratory Sciences (LS) staff analyses documented in this briefing package and the laboratory testing and observations were especially instructive in determining the most likely sequence of events involved in the majority of refueling incidents. Testing showed how an unnoticeable dying firepot flame can be capable of igniting the gel fuel

[15] TBSA is a measure of burn injury severity described in Section III of this memorandum.

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stream as it is poured into the burn cup (Kent, 2011). Once ignited during the refilling process, the flame can propagate back into the fuel storage container, where it can cause a near-instantaneous or a slightly delayed explosion of the gel fuel vapors. As detailed by ES staff (Ayers, 2011), this, in turn, greatly raises the container's internal pressure and can eject a forceful stream of ignited gel fuel several feet from the container's mouth (about 5 to10 feet is reported for incidents involving quart fuel bottle incidents, and more than 30 feet for a reported fatal incident involving a gallon storage container, IDI 110701CNE0001). Some incident reports have described a "*flamethrower-like*" emission of flames from the plastic bottle mouth, and some witnesses report hearing an explosive sound much like a gunshot.

During the refueling process, in order to pour the fuel into the burn cup, the long axis of the fuel bottle is rotated just past the horizontal position (more than 90-degree rotation) before being rotated in reverse direction back to the upright position. In typical situations where a firepot is located on a patio table, when the fuel is being poured into the firepot burn cup, the fuel storage bottle mouth is likely to be maintained for several seconds just above the firepot, with the bottle opening directed away from the "pourer." In this scenario, a person seated at the patio table, either opposite or to one side of the pourer, is most vulnerable to burn injury by a forcefully ejected stream of ignited fuel. This is because the fuel bottle mouth is likely to be aimed directly toward their chest and/or lap for several seconds, or directed toward their neck, face, and hair while the fuel bottle is rotated back to an upright position. The feet, legs, and trunk, and to a slightly lesser extent, chest, neck, and face of a person standing nearby the firepot are also particularly vulnerable to burn injury by the ejected fuel. Unlike a lighter fuel-related flash explosion, which is relatively short-lived, the spurt of ejected ignited alcohol gel fuel that lands on a victim does not burn off quickly. Instead, it sticks to the skin, resulting in a sustained burn that penetrates deeply into the skin and frequently, also ignites clothing. Many consumers have described the lit fuel to be "*like napalm.*" As noted by staff, the ignited gel fuel is not extinguished easily by smothering; rather, it is spread more extensively by water dilution or by "stop, drop, and roll" maneuvers (Kent, 2011). The information above explains why, in many incidents, the victims who sustained the most severe injuries were not actually involved in the refueling process (36 of 49 refueling incidents), and why they, and those trying to assist them, also frequently sustained serious burn injuries to the hand.

Staff is aware of 49 incidents involving the refueling scenario, which resulted in burn injuries in one or more victims (61 total victims) with at least 35 high-severity burn victims needing hospitalization and two victims who eventually died from complications related to their injuries. Details on the extent of burns are frequently missing for the hospitalized cases; but at least nine victims of this scenario reportedly sustained from 20 percent to 70 percent TBSA burns.

2. Explosion While Lighting Firepot:

Explosion of the gel fuel in a firepot's filled burn cup, as it was intentionally being lit by a consumer, was reported in five incidents. Based on the information provided in three cases, the firepot had already been in use that day, and it was being relit after just being refilled. In two cases, it was not clear whether the firepot had been in use previously that day.

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These five incidents account for nine burn victims, with at least four victims who were hospitalized with high-severity burn injuries. In an incident on May 28, 2011, a witness was adamant that the firepot had been refilled after previously being used that evening, but had been left for "at least 5 to 10 seconds" while the homeowner "looked around for a lighter to light the fuel"; she reported that as soon as a lighter was brought to the refilled firepot, the gel fuel "exploded into a giant fireball," depositing "flaming gel all over." In that incident, a 63-year-old man sustained 40 percent to 45 percent TBSA burns involving face, neck, hands, arms, lower legs, and feet. He required life support, multiple surgeries, and reportedly was placed in a medically induced coma for six weeks; he was still hospitalized and unable to speak when the CPSC investigation was completed (IDI 110620CNE1236).

A news report describes an incident on May 21, 2011, in which a 33-year-old woman was hospitalized with serious second- and third-degree leg burns (IPII X1170024A). The report noted that just after putting their children to bed, her husband "leaned over to light a ceramic firepot full of citronella gel to keep the bugs away. Flame hit the jelly-like fuel and . .. . WHOOSH . . . (she) was suddenly on fire." The news report stated: "The flames leaped several feet from the pot to where she was sitting on a love seat."

3. Fuel Bottle Explosion (Delayed):

Fuel bottle explosion scenarios describe explosion of a fuel storage container that is a short distance away from a lit firepot. Although not confirmed by testing, ES staff's memo (Ayers, 2011) describes a likely chain of events for this scenario, which appears to be a delayed consequence of the fuel bottle contents igniting during refilling. When fuel in an upright storage container is ignited, the fuel erupts vertically from the bottle mouth and "showers" nearby objects and individuals with "globs of burning gel."

This scenario has been reported by consumers in two incidents, but limited details are available for each case. In an incident on April 11, 2011, which involved a gallon fuel container, a 50-year-old man was hospitalized for an unspecified duration. The limited details state: "Consumer reports poured the citronella fuel from a gallon jug into a ceramic urn, lighted the urn with a long BBQ lighter and placed the jug of fuel a foot away when vapors or fumes ignited and the jug of fuel exploded. A 50-yof [year old female] sustained injuries and was hospitalized" (IPII I1150464A).

In the second incident, the 25-year-old female victim reported to CPSC: "We poured (brand X) fuel gel into our fire pot and lit it. We sat the bottle of gel about a foot away from the pot. (We don't remember if the top was on or off the bottle.) All of the sudden, the bottle exploded. The gel that passed over the open flame of the pot ignited and landed on me. (It sounded like a gunshot.) The flash sunburned my face, synged (*sic*) my eyelashes, and burned my left ear. It caught my left arm, back, hair and shirt on fire." She states further: "My concern is that I was NOT pouring the gel into an open flame, or an empty, hot resevior (*sic*) when it combusted, like MANY stories I have heard," which suggests that the firepot had not been in use previously on this occasion (IPII I1180102A).

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4. Ejection of the Metal Burn Cup During Use:

Spontaneous ejection of the burn cup from a lit firepot has been reported in six incidents. Though not observed in staff laboratory testing, the underlying cause likely involves excessive heat-related pressure buildup in the unvented internal space between the ceramic pot and the burn cup. Single victims were reported in three of the six incidents, and only one victim was hospitalized. In this case, a news report indicates that the burn cup spontaneously ejected from the firepot after being in use for about 90 minutes. It landed in the lap of an adult male, who was hospitalized with third degree burns to arms and second degree burns to legs (X1190020A).

5. Explosion of Fuel in the Firepot During Use:

Spontaneous explosion of the fuel in the firepot's burn cup during use has been reported in four incidents. The underlying mechanism is not clear. Single victims were injured in three cases, with one victim, a 5-year-old boy, reportedly hospitalized for four days for burn injuries to his face, eyes, and chest (IPII H1190047A). In the no injury (human) incident, a dog was set on fire; in the process of sustaining high-severity burns, the dog ran into a house, causing a fire and substantial property damage (IPII I1150278A).

6. Firepot Tip Over:

Some firepot shapes (top-heavy, narrow base) appear to be less stable than others. Tip over of lit firepots can occur if the firepot or the surface supporting the firepot is bumped or the firepot itself is knocked. This results in spillage of the burning gel fuel that can pour over the edge of the supporting surface, onto nearby victims. Staff is aware of three separate tip-over incidents, in which 6 victims were burned with 4 being hospitalized for their serious injuries (2 year-old girl and 8 year-old boy in separate incidents, and a 37 year-old woman and 25 year-old man in the same incident). In this case of the 8 year-old boy, the firepot reportedly had been placed on a bar stool in order to be kept away from young children. In an unwitnessed event, the child somehow tipped over the firepot and its ignited fuel contents poured down on him. He was hospitalized for more than 30 days with greater than 30 percent TBSA burns involving his face and arms and chest (IDI 100412CBB1567 and multiple IPIIs, including X1080041A).

7. Firepot Breakage While in Use:

Spontaneous breakage of the ceramic firepot while in use has been reported in three incidents. The underlying cause of the breakage is not clear, but it could involve defects in the ceramic pot and/or excessive heat-related pressure buildup in the unvented internal space between the ceramic pot and the burn cup. Notably, one report stated that the ceramic pot shattered, sending pottery shards flying, suggesting perhaps, a potential for projectile-related injury.

8. Explosion While Snuffing-Firepot

A single incident report indicates that a fire resulted indoors when a 42-year-old woman attempted to extinguish a firepot, using for the first time, the snuffer device supplied. The report indicates: "She had never used the snuffer before. She held the snuffer in her right hand and as carefully as she could began to place it over the four-inch flame. The complainant said all of the

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sudden the flame erupted, “like a volcano.” Flaming gel spurted out from the pot toward an adjacent wall up to five feet away. She said the gel landed on her furniture and carpeting and continued to burn with an orange flame. Although several thousand dollars worth of property damage resulted, no one was hurt in this incident (IDI 110608CWE5003).

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Table 1. Reported Firepot and Gel Fuel Incidents: Scenarios and Injury Severity*						
Incident Scenario	**No. of incidents**	**No. of "no-injury" incidents**	**No. of Injury incidents**	**No. of Injured Victims (minimum counts**)**	**No. of Hospitalized Victims *(minimum counts**)***	**No. of Deaths**
Refueling firepot *(pouring fuel/immediately post pouring)*	49	0	49	61	35	2
While actually lighting fuel *(after filling or refilling firepot)*	5	0	5	9	4	0
Fuel storage container exploded *(delayed, not while pouring fuel)*	2	0	2	2	2	0
Metal burn cup ejected spontaneously while in use	6	3	3	3	1	0
Explosion of fuel in burn cup while in use	4	1	3	3	1	0
Firepot tip-over incidents	3	0	3	6	4	0
Firepot broke spontaneously while in use	3	3	0	0	0	0
Explosion while snuffing	1	1	0	0	0	0
Limited Details (preclude classification of scenario)	3	1	2	2	1	0
Totals (all cases)	**76**	**9**	**67**	**86**	**48**	**2**

**Per HS and EPHA joint review of incidents reported up to 9/30/11.*
. *minimum counts because some incidents cases have limited details*

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III. Burn Injuries

Burn injuries are classified by the depth of tissue burn, which is expressed as the degree of burn (first-, second-, or third-degree; see Table 2) (Based on Wolf and Herndon, 2000; Singer 2000)

Table 2. Burn Type: Classification by Depth of Injured Skin

Depth	Histology	Skin Appearance	Sensation	Healing
First-degree	Outer skin layer-epidermis	Red, blanches under pressure	Mild to moderate pain	Heals 3–6 days with no scarring
Second-degree *superficial*	Epidermis and upper dermal layer	Red, blisters, moist, elastic, blanches under pressure	Severe pain (due to exposed nerve endings)	1–3 weeks, scarring unusual, area hypersensitive to sunlight
deep	Epidermis and deep dermal layers	White and red areas, dry, less elastic, reduced blanching under pressure	Pain can be decreased in areas where nerve endings damaged	>3 weeks; scarring and contractures likely; can require skin grafts
Third degree*	Full thickness skin burns (epidermis and dermis)	White, charred, tan; dry leathery; does not blanch under pressure	No pain perceived because nerve endings destroyed; surrounding areas of 2nd degree burn extremely painful	Will not heal spontaneously; requires skin grafts (often multiple surgeries); severe pain, contractures and scarring

Some experts describe especially severe, deep third-degree burns involving tissues beneath the skin as **fourth-degree burns.*

Burn severity is a function of victim age, burn depth, extent of burn (generally expressed as the percent TBSA that has second or third degree burns), and by the specific location of the burned area(s): (*face, ears, hands, feet, joints, genitals, and perineum are considered critical areas*). As a general rule, any injuries involving second- or third-degree burns in critical areas, and/or greater than 20 percent TBSA, are considered high severity, and require hospitalization. Any injuries involving second- or third-degree injuries in critical areas or greater than 10 percent but less than 20 percent TBSA are serious and require specialized treatment and possible hospitalization. Any injuries involving less than 10 percent TBSA and/or less than 2 percent third-degree burns are considered minor and do not necessarily require medical treatment (Wolf and Herndon, 2000; Singer 2000; The Merck Manual, 1992).

As is evident from the incident data, when burning gel fuel comes into contact with skin or clothing, it can present a serious burn injury hazard that can affect victims of any age (victim age range is 2 to 84 years). The injuries can range from minor to extremely high severity, and two victims are known to have died from severe burns sustained in refueling scenarios. Victims' upper bodies are often engulfed in flames; consequently, resulting injuries can be extensive and life-threatening. Multiple victims who have survived their burn injuries required life support in intensive care units. Detailed information is not available for more than a few hospitalized cases involving high-severity injuries; but CPSC is aware of at least 15 hospitalized victims who were admitted for extensive periods (from 10 to 76 days based on the most recent update of each specific case) and 11 cases specifically note between 20 percent to 70 percent TBSA. The recovery process from extensive high-severity burns is long, extremely painful (repeated removal of burnt and necrotic tissue) and complicated, requiring multiple surgeries (removal of necrotic tissue, replacement skin grafts, and relief of contractures, where coagulated scar tissues disrupt tissue blood and fluid supply). Due to the loss of integrity of the skin barrier separating internal

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body tissues from the environment, victims are at risk of delayed death from complications, including shock, fluid loss, and infection (the two known deaths from refueling scenarios occurred 4 and 33 days post-burn injury). Once the physical healing is complete, victims are left with extensive deep scarring, permanent disfigurement and functional impairment, and severe psychological trauma, especially if the face is involved (Wolf and Herndon, 2000, Singer 2000; The Merck Manual, 1992).

IV. Conclusions

The use of gel fuels with firepots presents a high likelihood of fuel explosions, spills, and consequently, presents a high risk of severe burn injury. As is evident from the incident data and two known deaths, extensive life-threatening, second- and third-degree burn injuries are very likely in the event of alcohol gel fuel explosion or spillage, particularly in refueling and tip-over scenarios. The high severity of reported burns is related to the propensity of the gel fuel to ignite and explode, the tendency of the viscous gel fuel to stick to skin and clothing, coupled with the fact that gel fuel fires are extremely difficult to extinguish with proper fire suppression equipment. The end result is a prolonged burn time that increases the area and depth of tissue damage.

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V. References

Miller, D. (2011) Firepot and Gel Fuel Incident Data as of September 30, 2011, CPSC Staff Memorandum, Division of Hazard Analysis, Directorate for Epidemiology.

Kent, J. (2011) Firepot and Gel Fuel Characteristics and Flammability Properties, CPSC Staff Memorandum, Division of Flammability and Electrical Engineering

Ayers, S. (2011) Engineering Analysis of Gel Fuel Bottles/Containers, CPSC Staff Memorandum, Division of Combustion and Fire Sciences, Directorate for Engineering Sciences.

The Merck Manual, 16th Edition, (1992), Burns, Ch. 257, pp 2500-2508, Berkow, R, Flecther, A.J., Beers, M.H. (Eds.):, Merck & Co., Inc., Rahaway, New Jersey.

Singer, A.J. (2000) Thermal Burns and Radiation Injuries. In Mattox, K.L. Feliciano, D.V., Moore, E.E. (Eds.), *Trauma* (4th Edition), Ch. 49, pp 1137-1152, McGraw Hill, New York.

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TAB D: Firepot and Gel Fuel Characteristics and Flammability Properties

TAB D

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

Memorandum

Date: November 20, 2011

TO: Rohit Khanna, Project Manager
Office of Hazard Identification and Reduction

THROUGH: Andrew Stadnik
Associate Executive Director
Directorate for Laboratory Sciences

Edward Krawiec
Director, Division of Flammability and Electrical Engineering

FROM: Jonathan Kent
General Engineer, Division of Flammability and Electrical Engineering

SUBJECT: Firepot and Gel Fuel Characteristics and Flammability Properties

INTRODUCTION

U.S. Consumer Product Safety Commission (CPSC) staff received reports of injuries associated with firepots and gel fuels. After reviewing the incident data, staff from the Directorate for Laboratory Sciences (LS) and the Directorate for Engineering Sciences (ES), conducted a series of experiments to try to replicate the scenarios described in the incident reports.

Firepots introduce several hidden dangers to consumers, primarily because the combustion properties of gel fuels are much different from other common household fuels, such as lighter fluid; and the hazards of firepots are much different from similar products, such as candles and oil lamps. Consumers using firepots are not likely to know how to effectively extinguish a gel fuel fire or are unlikely even to have the fire safety equipment required to do so readily available. The apparent size and brightness of an efficiently burning gel fuel fire does not indicate clearly its heat release rate as with fires of other typical fuels (gasoline, kerosene, lighter fluid). Gel fuel can be ignited easily by small ignition sources, such as smoldering material, and it can be ejected significant distances from the firepot and in reasonably foreseeable scenarios. These four hidden dangers contribute to the overall hazard to consumers of firepots using gel fuel. These hazards combine to create a high likelihood of injuries.

DISCUSSION

Gel Fuel Suppression
Many gel fuels used in firepots have very high viscosities. This prevents spilled fuel from spreading into a large-diameter pool. Due to the heat transfer mechanics of a pool fire such as

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this, the rate of combustion of fuel increases proportionally with the increasing pool area. When a gel fuel spill occurs, it will remain small, as compared to a similar fire with liquid fuel. However, due to the gelling agent, suppression of the spill can be quite difficult. The gel fuel can stick to fabrics, and it will be spread when patted, rather than be extinguished. Gel fuel fires are also difficult to extinguish with water. Significant quantities of water are required for successful suppression. Consumers likely will attempt one or both of these suppression techniques as their initial attempt at suppression, potentially exacerbating the situation.

Visibility

Gel fuels burn without producing much intermediary soot particles. This causes them to produce very little visible light when burning efficiently. Because of this property, gel fuel fires are difficult to see compared to similar sized fires of other fuels. Particularly in scenarios where the gel fuel burns very efficiently, the gel fuel can be nearly invisible in daylight. When gel fuel spreads thinly on a flat surface, a very low visibility flame is produced. This could mislead consumers who are not aware of this property into believing that the gel fuel is not burning at all or is burning much less intensely than it appears.

Often, the firepot can support a very small flame or smoldering combustion in the base of the fuel cup after the fuel has been nearly exhausted. This can produce the illusion that the firepot has been extinguished, prompting users to refuel it. However, gel fuel is very easy to ignite, and will do so from a very small ignition source, such as that found in the base of a recently used firepot.

Spill Scenarios

Several different spill scenarios have been considered. The simplest case is that of a firepot spill on a flat surface. In such an instance, fuel was observed to be spattered up to 5 feet away from the original position of the firepot. The distance of fuel spatter will increase for scenarios in which the firepot falls from some height. Falls from table height (31″) were observed to produce fuel spatter of approximately 5 feet from the initial impact, but falls from bar table height (42″) were observed to produce fuel spatter up to about 9 feet from the initial impact. This could ignite other fuels and expose consumers who are a significant distance away from the fuel pot to burning gel fuel when a spill occurs. In the event of a spill, consumers are not likely to anticipate the significant distance that gel fuel can be spattered, resulting in consumers underestimating the dangers that a firepot presents.

Several other spill scenarios were reported but were not validated experimentally. These included breakage of the firepot, which resulted in a spill, as well as spontaneous ejection of the fuel cup. These scenarios were not observed in the lab, but they could be caused by weathering of the firepot over time, causing the firepot to shatter, or by explosive ignition of alcohol vapors within the firepot's base, potentially causing the pot to shatter or the cup to be ejected. Both of these scenarios present similar hazards as straightforward spilling scenarios present, and they would likely not be anticipated by consumers.

CONCLUSION

The danger to consumers of a firepot spill is threefold. It presents a significant burn hazard, it is difficult to suppress, and the hazards are likely to be unknown to consumers. The ejection of burning fuel can ignite other combustibles and burn consumers from an unexpectedly large

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distance from the spill incident. Once the spill occurs, the gel fuel fires will not be obvious in daylight, and consumers are likely to underestimate their severity. Finally, when a consumer attempts to suppress the fires using the most obvious means available, they are likely to exacerbate the situation.

POTENTIAL PERFORMANCE REQUIREMENTS

The danger of firepot tip-over scenarios stems from a high risk of accidental ignition of combustibles during typical use and consumers' lack of knowledge of these risks. Performance requirements to reduce the risk of injury could include increasing the stability of firepots to reduce the likelihood of accidental tip over, increasing the visibility of burning gel fuel through the use of additives, and reducing the ignitability of gel fuel, such that a tip-over event typically extinguishes the fuel.

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TAB E: Gel Fuel Chemical Composition

TAB E

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

Memorandum

Date: November 21, 2011

TO : Rohit Khanna, Project Manager
Office of Hazard Identification and Reduction

THROUGH: Andrew G. Stadnik, Associate Executive Director
Directorate for Laboratory Sciences

Joel Recht, Ph.D. ,Director,
Division of Chemistry
Directorate for Laboratory Sciences

FROM : Matthew Roemer, Chemist
Division of Chemistry
Directorate for Laboratory Sciences

SUBJECT : Gel Fuel Chemical Composition and other Relevant Properties

Background

U.S. Consumer Product Safety Commission (CPSC) staff received reports of fire incidents associated with gel fuels used in firepots. CPSC staff from the Directorate for Laboratory Sciences, Division of Chemistry (LSC) conducted tests to determine the chemical composition and other relevant material properties of these gel fuels to assist in the development of a hazard determination for these products.

Discussion

A total of 18 samples of gel fuels were analyzed by LSC staff to determine their chemical composition, viscosity, and flashpoint.[16]

A. Methodology

The alcohol-based fuels were analyzed for chemical composition, viscosity and flashpoint using the following instruments and methods:

[16] Flashpoint is the lowest temperature at which a material produces sufficient flammable vapors that the air/vapor mixture above the sample is ignited by a test flame under controlled conditions, producing a large, instantaneously propagated flame over the entire surface. A lower flash point indicates higher flammability.

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1. Chemical composition: Chemical composition was determined using Fourier-Transform Infrared (FTIR) Spectroscopy. FTIR conducted with Thermo Nicolet 6700 FTIR Spectrometer with Smart Orbit Diamond Attenuated Total Reflectance (ATR) accessory, DTGS KBr detector, resolution of 4 cm^{-1} and using a HR Aldrich search library.

2. Viscosity: Dynamic viscosity was determined using a Brookfield Digital Viscometer Model DV-I. Sample temperature: 25°C, Spindle: S52. ASTM D2983, "Standard Test Method for Low-Temperature Viscosity of Lubricants Measured by Brookfield Viscometer." (http://www.astm.org/Standards/D2983.htm)

3. Flashpoint: Flashpoint was determined using a Setaflash Series 8 flashpoint tester, according to ASTM D3278, Standard Test Method for Flash Point of Liquids by Small Scale Closed-Cup Apparatus. (http://www.astm.org/Standards/D3278.htm)

B. Results

An example of a typical FTIR spectrum for the alcohol-based fuels can be seen in Figure 1. Figure 1 shows a number of peaks representing absorption of infrared light at various energies (shown as wave numbers, which are the inverse of wavelengths) that are used to determine the chemical identity of this alcohol-based fuel, as chemicals absorb infrared energy, depending on molecular structure. This spectrum is then compared to several spectra in a reference library for a best match. In this case, Figure 1 matches closely to the FTIR spectrum of an Ethanol Standard (Figure 2).

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Figure 1: FTIR spectrum for sample number 11-810-6843-03

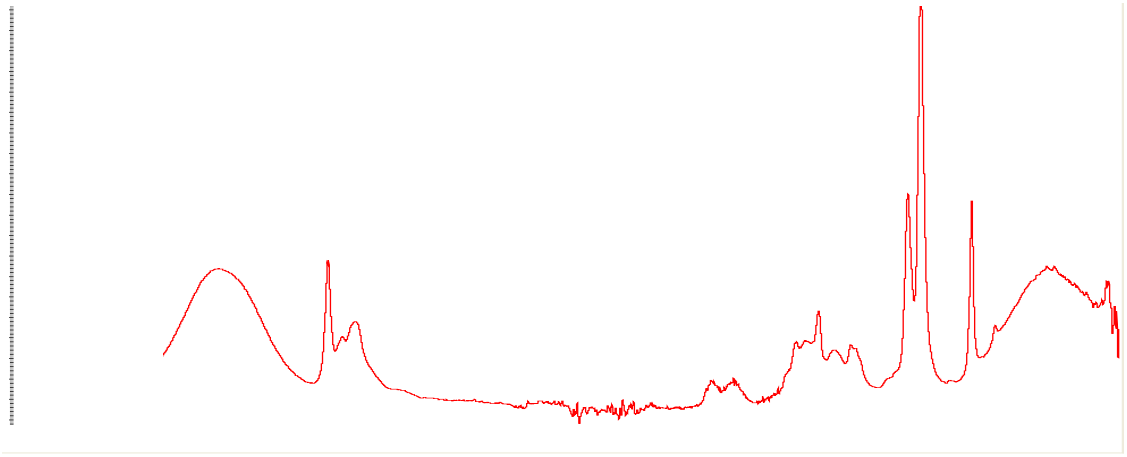
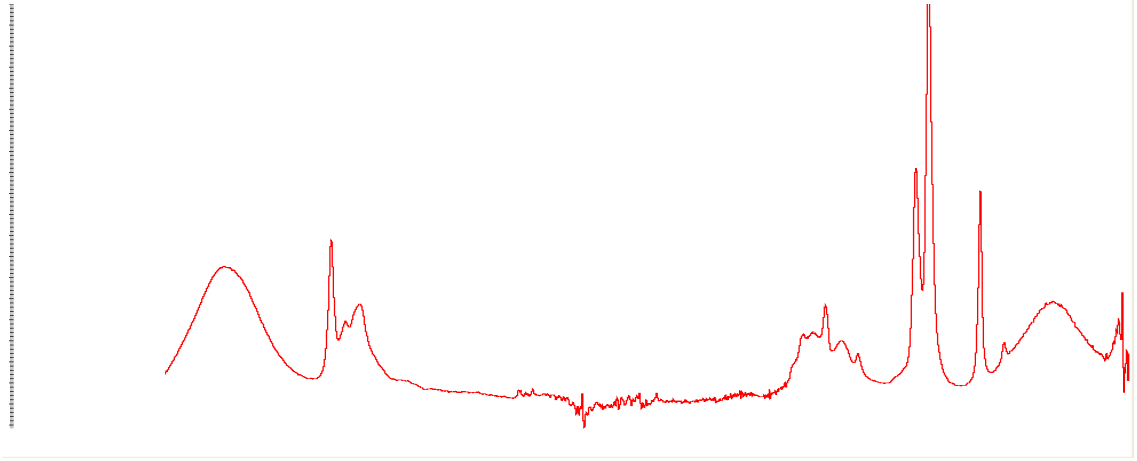


Figure 2: FTIR spectrum for an Ethanol Standard (200 proof)



Eighteen different liquid fuels from several manufacturers were analyzed. A breakdown of each test result is given in Table 1.

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Table 1: Liquid Fuels Chemical and Material Properties

Sample number	Chemical composition	Flashpoint (°F)	Viscosity (cP)**
11-302-1371-02	60-70% Ethanol, 20% Isopropanol	72.0	25,820
11-302-1372-09	60-70% Ethanol, 20% Isopropanol	74.2	21,720
11-302-1373-06	80-90% Ethanol	66.0	5,054
11-302-1382-07	80-85% Isopropanol	70.2	17,730
11-302-1383-04	80-85% Isopropanol	74.1	17,920
11-810-6616-11	70-80% Isopropanol	72.0	too high to measure under these conditions
11-810-6843-03	90-95% Ethanol	57.2	5,331
11-810-6844-01	90-95% Ethanol	59.3	7,038
A-1	70-80% Isopropanol	70.5	15,220
A-2	70-80% Isopropanol	73.0	15,960
A-3	70-80% Isopropanol	73.0	14,460
B-1	80-90% Ethanol	66.0	7,884
B-2	80-90% Ethanol	69.8	5,209
11-302-1300-02	60-70% Ethanol, 20% Isopropanol	69.0	8,991
11-810-6605-05	90-95% Ethanol	50.0	too low to measure under these conditions
11-302-1302-06	70-80% Isopropanol	72.0	20,890
11-302-1824-02***	90-95% Ethanol	36.0	9,395
11-302-1824-01***	90-95% Ethanol	32.0	8,092

**Note: Water at room temperature has a viscosity of 1cP; food grade honey has a viscosity of ~10,000cP.

***Note: These two samples contained butane.

Conclusion

The gel fuels examined by LSC staff were alcohol-based, generally containing approximately 80 percent alcohol with the balance being water, gelling agent, and additives like citronella. Flashpoint was determined to be between 32°F to 74°F, and the viscosity typically fell in a range from 5,000 cP to 25,000 cP.

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TAB F: Gel Fuel Container Hazards

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

Memorandum

Date: November 21, 2011

TO : Rohit Khanna, Project Manager
Office of Hazard Identification and Reduction

THROUGH: George A. Borlase, Ph.D., Associate Executive Director
Directorate for Engineering Sciences

Patricia K. Adair, Director,
Division of Combustion and Fire Sciences
Directorate for Engineering Sciences

FROM : Scott Ayers, Fire Protection Engineer
Division of Combustion and Fire Sciences
Directorate for Engineering Sciences

SUBJECT : Engineering Analysis of Gel Fuel Bottles/Containers

INTRODUCTION

Gel fuel bottle/containers used in open-flame applications (like with firepots, where no permanent structure separates the flame from possible human contact) have been involved in numerous consumer incidents over the past two years. Most of these incidents involve a reported "explosion" of alcohol gel fuel during a refilling process. In some incidents, the consumer thought the flame was not present; in others, the consumer knew the flame was still burning. As of September 30, 2011 two consumers have died as a result of refilling a firepot. The U.S. Consumer Product Safety Commission (CPSC) has worked with industry to recall[17] most alcohol fuel gel bottles.

This memorandum provides the results of an examination of the gel fuel bottles and an analysis of the mechanism that caused the reported explosion incidents during and after refilling. Currently, there are no mandatory or consensus-based voluntary standards addressing gel fuel bottles used with firepots. This memorandum discusses four criteria that staff are using to address firepot refilling incidents. The Commission could consider these criteria as it examines regulatory options to address incidents involving gel fuels used with firepots.

[17] CPSC press releases: #11-255, #11-315, #11-336, #11-337,#11-338, #11-339, #11-340, #11-344, #12-002, #12-007, and #12-020.

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DISCUSSION

Scope

This memorandum evaluates the hazards associated with an alcohol gel fuel bottle/container when used in an open-flame product such as a firepot that is being refilled. The other hazards posed by firepots, as reported in the incident data, are not addressed here. The actual physical mechanism for the hazard within the bottle applies to liquid alcohol fuel as well.

Engineering Analysis

The firepot fuel is typically comprised of a solution of alcohol, water, a gelling agent, and small amounts of other additives. Typically, the alcohol comprises at least 80 percent by volume and includes either ethanol (ethyl alcohol), isopropanol (isopropyl alcohol), or a mixture of the two. Two fuel bottles were found to contain butane. Table 1 lists properties for these alcohols and other common fuels.

Table 1. Flammability Properties of Selected Fuels (Note: Class IB liquids have flash points below 73 F and a boiling point above 100 F; Class 1C liquids have a flash point between 73 F and 100 F; Class IIIA liquids have a flash point between 140 F and 200 F)

Fuel	Lower Flammable Limit (LFL) Vol%	Upper Flammable Limit (UFL) Vol%	Class	Vapor Pressure at 20 C mm of Hg
Ethanol	1.6	19	IB	44
Isopropanol	2.65	12	IB	33
Methanol	6 – 6.7	36	IB	99
n-Propanol	2.5	12	IB	14.5
n-Butanol	1.4	11.2	IC	4.4
Isobutanol	2	11	IC	8.8
Gasoline (RVP=10)	1.4	7.6	IB	320
Diesel No. 2	0.6	7.5	IIIA	0.5
Naphtha (Charcoal Lighter Fluid)	0.9	6.7	IB	5.0

The lower flammable limit (LFL), sometimes referred to as the lower explosive limit, and the upper flammable limit (UFL), sometimes referred to as the upper explosive limit, are the bounding concentrations of gaseous fuel in air needed for sustained burning or explosion. The class pertains to NFPA 30[18] and U.S. Department of Transportation classification of the liquids. Vapor pressure is the gaseous partial pressure above a liquid's surface, regardless of the viscosity and the total pressure; the vapor pressure is dependent on temperature and increases exponentially with temperature until boiling is reached.

The majority of the reported incidents involve reported "explosions" and/or ejecting of burning alcohol fuel during refilling or bottles "exploding" after refilling. These phenomena can be explained by understanding the chemistry within the vapor space (headspace) of the bottle. In

[18] National Fire Protection Association 30, *Flammable and Combustible Liquids Code*

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the case of ethanol, isopropanol, and methanol at room temperature, the concentration of the alcohol vapors is above the LFL and below the UFL. Therefore, at room temperatures there is an explosive concentration within the alcohol fuel bottle headspace. When exposed to an open flame, this atmosphere will cause a deflagration-type explosion.[19] Under the right conditions with sufficient vapor space, staff testing has confirmed this deflagration can simultaneously ignite and eject the fuel several feet from the bottle. Table 2 details the fuel vapor concentrations of the selected fuels.

Table 2. Atmospheres Within Containers of Selected Fuels. Vapor concentrations found from vapor pressure; ethanol, isopropanol, and methanol concentrations are all between the LFL and UFL; n-propanol, n-butanol, and isobutanol are all below the LFL at 20 C but may be above it at higher temperatures.

Fuel	LFL	UFL	Vapor Concentration at 1 atm & 20 C	
			Open Container	Sealed Container
	Vol%	Vol%	Vol%	Vol%
Ethanol	1.6	19	5.8	5.5
Isopropanol	2.65	12	4.3	4.2
Methanol	6 – 6.7	36	13.0	11.5
n-Propanol	2.5	12	1.9	1.9
n-Butanol	1.4	11.2	0.6	0.6
Isobutanol	2	11	1.2	1.1
Gasoline (RVP=10)	1.4	7.6	42.2	29.7
Diesel No. 2	0.6	7.5	0.1	0.1
Naphtha (Charcoal Lighter Fluid)	0.9	6.7	0.7	0.7

The use of firepots demonstrates the hazard of using alcohol fuel bottles with open flames. The reported incidents show that the open flame can ignite the explosive atmosphere inside the container and eject burning fuel.

Figure **5** diagrams the most likely cause for the ejection of burning alcohol fuel during refilling. For this to happen, the bottle must have a sufficient amount of gaseous headspace but still have a substantial amount of fuel remaining. The amount of gaseous headspace governs the energy of the explosion, which then ejects the remaining liquid/gel fuel. If the bottle is in an orientation where fuel is near the bottle throat and a flame is able to penetrate into the headspace igniting the explosive atmosphere, an explosion can occur, which rapidly increases the pressure inside the bottle, ejecting the remaining liquid or gel fuel, igniting it as it exits. If the fuel is away from the throat of the bottle, the pressure increase forces the fuel back into the bottle. Of the 32-ounce bottles tested by staff, no explosion was powerful enough to cause the bottle to rupture.

[19] A deflagration-type explosion is propagated by thermal (heat) energy and travels at subsonic speeds. Whereas a detonation-type explosion is propagated by pressure energy and travels at supersonic speeds.

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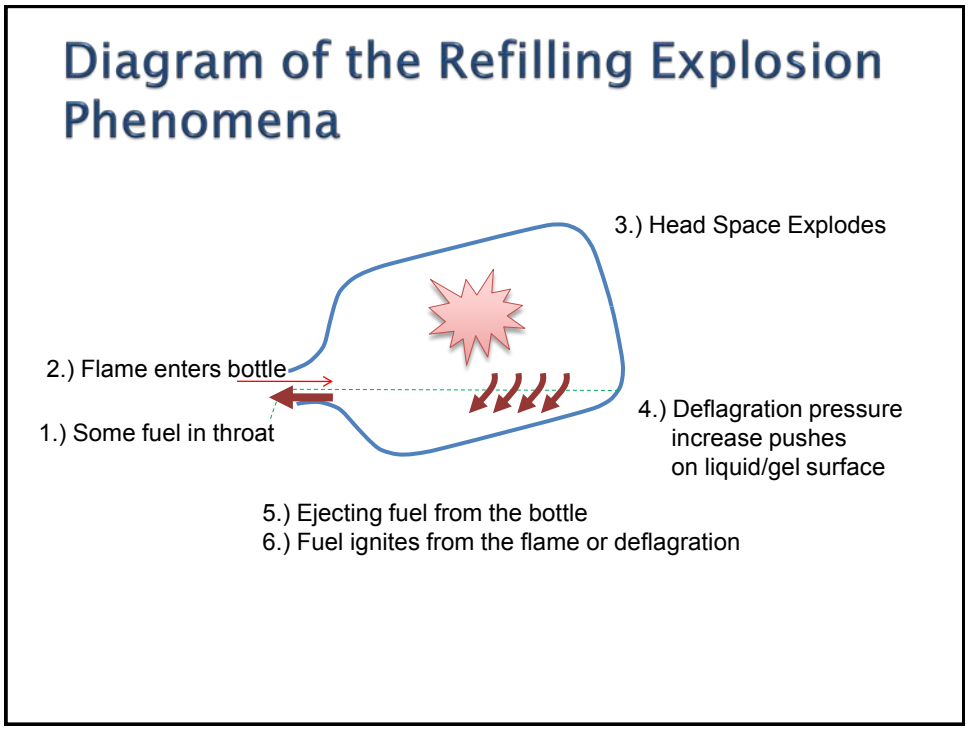

Figure 5. Diagram of the most likely cause of flaming alcohol fuel ejecting while refilling in the presence of a flame

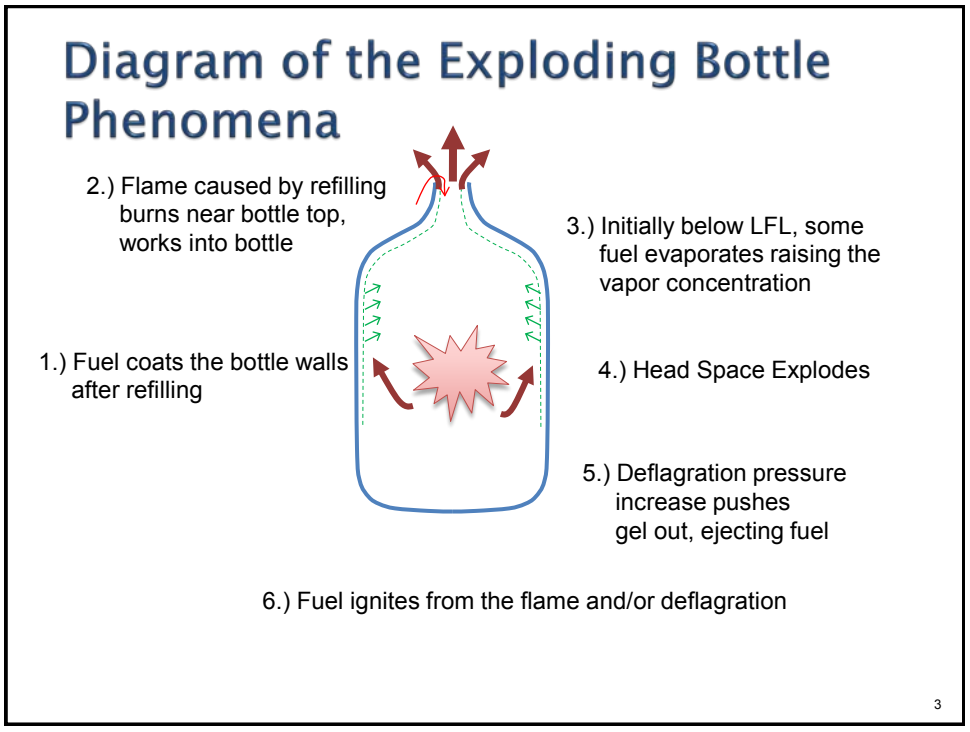

Figure 6. Diagram of a hypothesis of a cause of flaming alcohol fuel ejecting after refilling in the presence of a flame

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Figure 6 illustrates a hypothesis of what may be causing the ejection of burning alcohol fuel after refilling. This hypothesis was not tested by staff due to safety concerns. For this phenomenon to happen, the bottle must have a sufficient amount of gaseous headspace and have a fairly viscous fuel that "sticks" to the walls of the fuel bottle. Testing has shown that sometimes after refilling the firepot in the presence of a flame, if the bottle contents did not explode, a small flamelet may exist on the very outside of the throat near fuel that is "stuck" at the throat. If the bottle is placed down with the throat up, and sufficient time is allowed for alcohol to evaporate, the flamelet could burn back into the bottle, potentially igniting an explosive atmosphere. The ensuing explosion would increase the pressure inside the bottle, pushing fuel that is "sticking" to the top surfaces inside of the bottle out of the bottle, igniting it as it exits the throat.

Corrective Action Guidance to Industry

Staff recognized the inherent hazards with alcohol fuel bottles, and subsequently, recalls were announced. Currently, industry is working on corrective actions to improve the safety of these products. Staff is not aware of any existing mandatory or consensus voluntary standards that address alcohol fuel bottles used in open-flame applications by consumers. CPSC Engineering Sciences staff provided four criteria to the industry, which staff will use to evaluate potential corrective actions with respect to firepot refilling hazards:

1. Any safety feature must be permanently attached to the bottle so that the consumer cannot reasonably remove it;
2. There must be a mechanism to prevent hot gases and/or flames from coming in contact with and igniting the explosive atmosphere in the bottle headspace;
3. Any safety feature must be robust and continue to function at the end of the foreseeable worst-case lifetime of the bottle; and,
4. Any safety feature added to the bottle must not impede the function of the product such that the consumer would be likely to remove or otherwise bypass the safety feature.

Simply limiting the opening area will reduce the risk of a flame penetrating into the bottle, but it does not eliminate it. Testing by CPSC staff has demonstrated that reducing the opening area for pouring the fuel can still produce an explosion; a reduced area opening deflagration can increase the internal pressure rise within the bottle, ejecting the alcohol fuel with greater velocity, sending fuel farther away, and this potentially can cause the fuel bottle to rupture catastrophically, sending fuel in multiple directions.

Potentially Relevant Standards

This product class may be governed partly under both National Fire Protection Association (NFPA) voluntary standard NFPA 30, *Flammable Liquid Code*, and the U.S. Department of Transportation (DOT) 49 CFR 100–199, *Other Regulations Relating to Transportation*. NFPA 30 governs the storage and commercial use of flammable liquids. Specifically, NFPA 30 Chapter 18.3.3 partially states: "Class I liquids shall not be used outside closed systems where there are open flames." The DOT would govern the commercial transportation of alcohol fuel bottles. Neither of these standards specify requirements for these products that would address the hazards staff has identified in the reported incidents.

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Possible Regulatory Options

One of the regulatory options available to the Commission is to develop a performance safety standard for containers of gel fuel that is intended for use with firepots. The four criteria that staff developed for evaluating corrective actions could be considered for such a standard. Other safety criteria specific to firepots, not addressed in this memorandum, could also be incorporated.

CONCLUSION

Alcohol fuel bottles/containers used with firepots present a high fire and burn risk to the consumer. The bottle headspace contains an explosive mixture of alcohol vapors in air that when exposed to an open flame and when positioned in a certain orientation can result in an explosion ejecting flaming fuel several feet away. Currently, no mandatory or consensus-based voluntary standards addressing this hazard exist. CPSC staff has developed four criteria that the Commission could consider in examining regulatory options to address incidents involving gel fuel used with firepots.

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TAB G: Firepot and Gel Fuel Characteristics, Use Patterns, and Risk of Injury

TAB G

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
4330 EAST WEST HIGHWAY
BETHESDA, MARYLAND 20814

Memorandum

DATE: November 21, 2011

TO: Rohit Khanna, Project Manager
Office of Hazard Identification and Reduction

THROUGH: George A. Borlase, Ph.D., Associate Executive Director,
Directorate for Engineering Sciences

Robert B. Ochsman, Ph.D., Director,
Division of Human Factors
Directorate for Engineering Sciences

FROM: Rana Balci-Sinha, Ph.D., Engineering Psychologist,
Division of Human Factors (ESHF)
Directorate for Engineering Sciences

SUBJECT: Human Factors Assessment of Firepots and Gel Fuels

INTRODUCTION

Firepots, used in conjunction with gel fuel, have recently become popular to generate decorative lighting in indoor and outdoor use. Firepots are usually made of earthenware, house a removable cup as a fuel reservoir, and are supplied with a metal snuffer to extinguish the fire. This memorandum provides an assessment of the warnings and labels in addressing the primary hazards associated with the use of firepots and gel fuels and discusses human factors issues related to possible regulatory options to address these hazards.

DISCUSSION

Most of the firepots examined have a warning directing the consumer not to leave the burning firepot unattended and to keep it away from children and pets. Some firepots instruct the user to place the firepot only on a flat and level surface.

FHSA Warning Analysis

According to the Federal Hazardous Substances Act (FHSA): Labeling and Banning Requirements for Chemicals and Other Hazardous Substances, fuel containers should carry a flammable warning if the flashpoint of the substances is above 20°F and below 100°F. All of the sample gel fuel bottles examined by ESHF have either the "flammable" or "flammable liquid" warning on the bottle. With the exception of one brand, they also carry the hazardous material

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flammable warning symbol. All of the examined fuel bottles have the name of the chemical, name of the manufacturer or distributor, instructions for special handling and storage, first aid instructions, and the statement warning consumers to keep the bottles away from children. With the exception of one brand, the bottles carry the signal word[20] as well. Per the FHSA, the precautionary measures to follow are required to be placed on the label. One of the precautions that consumers must take is not to refill the firepot while the pot is still hot or burning to prevent a flash fire. The FHSA does not require labeling of firepots.

As of September 30, 2011, CPSC staff is aware of 76 reported firepot/alcohol fuel incidents. Based on staff's review of the incident reports, a total of 49 incidents were related to the refilling action. Staff specifically examined the refilling warning in its evaluation of 12 fuel bottles and 12 firepots, as this is the most common hazard scenario. See Appendix for a sample of warnings associated with refilling.

Warning Conspicuity

Warnings that are placed directly on the product have higher noticeability compared to the warnings listed in a "distant" instruction manual (Wogalter et al., 1987). Considering that some consumers may not read warnings in an instruction manual (Conzola and Wogalter, 1996 as cited in Freeman, 2003), warnings that are particularly important because of factors such as injury severity or frequency of occurrence should be displayed on the product (Wogalter and Leonard, 1999).

Most of the firepot samples evaluated by staff have refilling warnings on the package, affixed on the product (one sample), or in the user instructions enclosed in the package. The packaging or the instruction sheet is likely to be discarded or set aside after the consumer opens the package. Only one firepot sample includes a warning label affixed to the product. However, this is not a permanent warning, and it is to be removed by the consumer before the initial use because it blocks the fuel cup. Overall, none of the firepots have permanent warning labels associated with the refilling scenario. Even though a user may read the warning at the time the product is first removed from the package or first used, subsequent uses of the product will not carry a warning, and subsequent users will not have a reminder of this hazard.

The majority of the fuel bottles have a refilling warning on the bottle; however, it is only one element in a long list of directions for use, or else it is included in the list of generic warnings, such as "keep it away from children" or "never leave a burning fire pot unattended." Two bottles have additional warning labels that include refilling, one located on the handle, and the other placed vertically on the bottle.

Users may notice a warning label but not read it. Attention must be maintained on the message for some time so that the meaning could be extracted from the material (Wogalter and Leonard, 1999). Certain design features are needed to maintain the attention of the user. These include using larger font sizes for improved legibility, use of color and contrast, and pictorial symbols. A proper hazard signal word is also needed, such as "DANGER," to indicate hazards where serious injury or death will occur, or "WARNING," to note that serious injuries might occur if

[20] *Signal word*: The word that calls attention to the safety sign and designates a degree or level of hazard seriousness.

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the warning is not followed. These signal words are to be accompanied by specific colors (red for "DANGER," orange for "WARNING," and yellow for "CAUTION") (ANSI Z535.4, 2007). The refilling warning on firepots and fuel bottles does not have enough visual differentiation from other warnings for the consumer to notice, stop, read, and modify behavior. Pictorial symbols increase the noticeability of the warnings because they help capture the user's attention (Wogalter and Leonard 1999). Graphic warnings induce an emotional response, increase memory and awareness of the risks, and they strengthen motivations to avoid the risks more than text warnings do (Hammond et al., 2007). None of the firepot or fuel bottle samples have pictorial symbols associated with the refilling hazard.

The warning messages should explain the nature of the hazard, the consequences of the hazard, and give instructions on how to avoid the hazard (Wogalter and Laughery, 2006). Providing explicit information about consequences can increase the perception of injury severity and perceived hazard (DeJoy, 1999). Only one warning label in firepots states the consequence of the hazard as "severe burns," and another warning states "severe injury can occur." None of the fuel bottles have a warning stating what the consequences of refilling the pot are while it is hot or the flame is still burning.

Perceived Hazardousness

The safer a product is perceived to be, the less likely that people will read the instructions and warnings that accompany it (DeJoy, 1989). Consumers acknowledge that there are circumstances in which they would not read any instructions accompanying a consumer product. This is strongly associated with consumers' assumptions about the simplicity of using a product (Wright et al., 1982). Also, the more familiar people are with a product, the less likely they are to read instructions and warnings (Wogalter et al., 1991; DeJoy, 1989). Prior experience with a product can affect consumers' perception of its hazardousness. If the same product has been used previously without incident, it may be perceived as safe (Karnes, Rachwal and Leonard, 1986).

Firepots appear to be simple and familiar decorative accessories that are easy to use. However, the combination of firepots and gel fuel is inherently hazardous due many reasons, including flames that are difficult to see, open cup burn configuration, and having an explosive container headspace. The decorative nature of the firepots and seemingly safe appearance of the packaging of the bottles, which has wording such as "environmentally friendly," "eco-friendly," "live safe, burn safe," and "non-toxic" may undermine the perceived hazardousness of the overall product and therefore may reduce the likelihood of a user looking through the list of warnings.

Product Familiarity

Warnings are only likely to be useful for unfamiliar products. Increased familiarity with a product reduces the likelihood of searching, reading, and complying with a warning (Wogalter, et al., 1991). Product familiarity may reduce the perceived risk. This situation can be most prominent when consumers start using a new product that looks similar to a previously used product but is likely to be more dangerous (DeJoy, 1999). Firepots may look familiar to the consumers who are used to operating a similar product safely, such as candle pots.[21] Consumers

[21] Candle pots are usually made of ceramic and hold wax candles.

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most likely may assume that a similar amount of risk exists for the newly marketed but familiar looking firepots and may not even bother to read the warnings.

Compliance with the Warnings

Staff has concerns about whether users reasonably can be expected to perform the steps required in the instructions to avoid refilling when the firepot is still hot or burning. The essential message that the warnings on both firepots and fuel bottles are attempting to convey is that the fuel should not be added to a burning firepot. Staff observed a number of tests that attempted to replicate the scenarios described in these reported incidents. When the fuel is added to a firepot with an almost invisible flame, a flash fire was observed. Depending on the viewing angle of the user and the lighting conditions, confirming that the fire is out may be practically impossible due to the clean burning, invisible flame. Examination of the incident scenarios that were reported to CPSC confirms this: A total of 49 incidents out of 76 were reported to have occurred during the refilling scenario. In 26 refilling incidents, consumers reported that the flame was out, or there were no visible flames, or that the firepot was out of gel fuel.

In 10 refilling incidents, consumers acknowledged that the flame was low, or the pot was hot, or there was a small amount of gel fuel left in the firepot before refilling. Staff believes that one possible reason for this oversight is that consumers may not be knowledgeable enough regarding alcohol-based gel fuels and the potential danger associated with flash fire. Further, people may believe that they already know how to use the product. Because of overconfidence, they may proceed without thinking, observing, checking, or reading instructions or labels. When people assume they know how something operates, they may make faulty judgments that lead to errors (Woodson et al., 1992).

In addition to the refilling scenario, certain firepots, depending upon the design features that affect the ultimate stability of the pot, can be tipped over easily. Based on the incident reports that staff reviewed, firepots are likely to be used in large gatherings with children and pets around. Staff believes that the tip-over scenario is likely to occur depending on the external factors, such as location of the firepot, user or bystander characteristics, and the product features.

Labeling as a Regulatory Option

Even when the warning messages can be modified to incorporate more effective methods to increase the noticeability, staff is concerned that the product itself in its current packaging will not likely motivate the consumer to look for or notice any warnings. The fuel bottles look like water bottles with regular caps. They appear harmless, are pleasant looking, and do not give a hazardous or dangerous impression. Further, bottles carry wording that engenders positive perception, such as “clean-burning,” “eco-friendly,” “earth-friendly,” and “non-toxic.” Familiarity has a negative correlation with warning detection, perceived hazard, perceived risk, and compliance likelihood (Wogalter, et al., 2002). Consumers may perceive this product as nonhazardous, and therefore, they may ignore even the most prominent warnings. This fact is amplified in the most common use scenario when the fuel is combined with a familiar-looking firepot that is decorative and that closely resembles other well-known products, such as candle pots. Therefore, given the characteristics of this product and foreseeable use by consumers, the

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opinion of ESHF is that warnings of any design will not be effective in engendering safe use of this product.

CONCLUSION

Staff conducted a human factors assessment of various firepots and fuel bottles and examined the adequacy of warnings and instructions to alert consumers to a severe burn hazard if refilling occurs when the firepot still has a flame or is hot. The majority of the firepots and fuel bottles have some kind of warning associated with the hazard. A refilling warning is included in the list of warnings, usually located on the package or in the instruction manual. In general, refilling warnings are not differentiated from other warnings by font type, color or size to attract the consumer's attention. There are no permanent warnings on the firepots. After the product package and instructions are discarded, there are no reminders left for future users to read. Firepots have no warning label on the product that could serve as a permanent reminder to the users, and the warning on the fuel bottles does not get the user's attention. Even when the firepots and fuel bottles had permanent warning labels that incorporate design features for increased noticeability, consumers may find the product simple enough to ignore the warnings and instructions.

More importantly, staff is concerned that consumers will likely have difficulty in complying with the instructions to avoid the hidden hazard, particularly because the flames can be hard to see under certain lighting conditions and viewing angles, as confirmed by staff's testing and a number of incidents that were reported to the CPSC. The use of the product in informal gatherings with children and pets around exacerbates the risk of refilling by bystanders who may not be aware of the risks, as well as the tip over of the product.

Staff believes that the warnings, even when they are prominent, will likely fail to influence consumers into altering their behavior for this product. The product appears harmless and simple enough to make consumers believe that reading instructions and warnings is not necessary to operate the product, and even if they did, the signs that consumers need to be looking for may not be evident to confirm that the fire is out completely.

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TAB H: Firepot and Gel Fuel Market Information and Economic Considerations

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UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
BETHESDA, MD 20814

MEMORANDUM

DATE: November 22,2011

TO: Rohit Khanna, Project Manager,
Office of Hazard Identification and Reduction (EXHR)

THROUGH: Gregory R. Rodgers, Ph.D., Associate Executive Director,
Directorate for Economic Analysis
Deborah V. Aiken, Ph.D., Supervisory Economist,
Directorate for Economic Analysis

FROM: Charles L. Smith, Economist,
Directorate for Economic Analysis

SUBJECT: Firepots and Gel Fuels Market Information

Introduction

Firepots and gel fuels have been involved in 76 known incidents in 2010 and 2011, which have been associated with 86 burn injuries and two deaths.[22] Concern about the risk of severe burn injury with these products prompted voluntary recalls of pourable gel fuel bottles marketed by 12 firms this year.[23] The Directorate for Economic Analysis has reviewed publically available market and product information on firms and products, in addition to information developed by CPSC technical staff and the Office of Compliance and Field Operations. This memorandum discusses economic considerations related to a possible advance notice of proposed rulemaking (ANPR).

Firepots

Firepots are typically decorative ceramic vases, pots, or figures that feature holes in their tops that accommodate separate stainless steel or ceramic burn cups to hold gel fuel. The burn cups range in size from about 2.5 to 3 inches in diameter and about 3 inches deep. When the burn cups are filled with the recommended amount of gel fuel, the firepots reportedly can burn for about two hours; although consumers can extinguish the flame before the fuel burns completely by using a metal snuffing device that often is supplied with the firepot. Although most firepots are ceramic, they have also been manufactured with metal (*e.g.*, copper, zinc, or steel), and some bases for burn cups have been made of stone or glass. Firepots have been offered in a wide range of prices, from a little under $20, to more than $100. Most models seem to be priced at $20 to

[22] David Miller, Mathematical Statistician, Division of Hazard Analysis, Directorate for Epidemiology, CPSC. "Firepot and Gel Fuel Incident Data as of September 30, 2011." Memorandum to Rohit Khanna, Firepots and Gel Fuels Project Manager, EXHR, CPSC, November 4, 2011.
[23] In cooperation with the CPSC, one firm announced a recall of pourable gel fuels on June 22, 2011, nine firms announced recalls on September 1, 2011, and two firms announced recalls on October 11 and 25, 2011.

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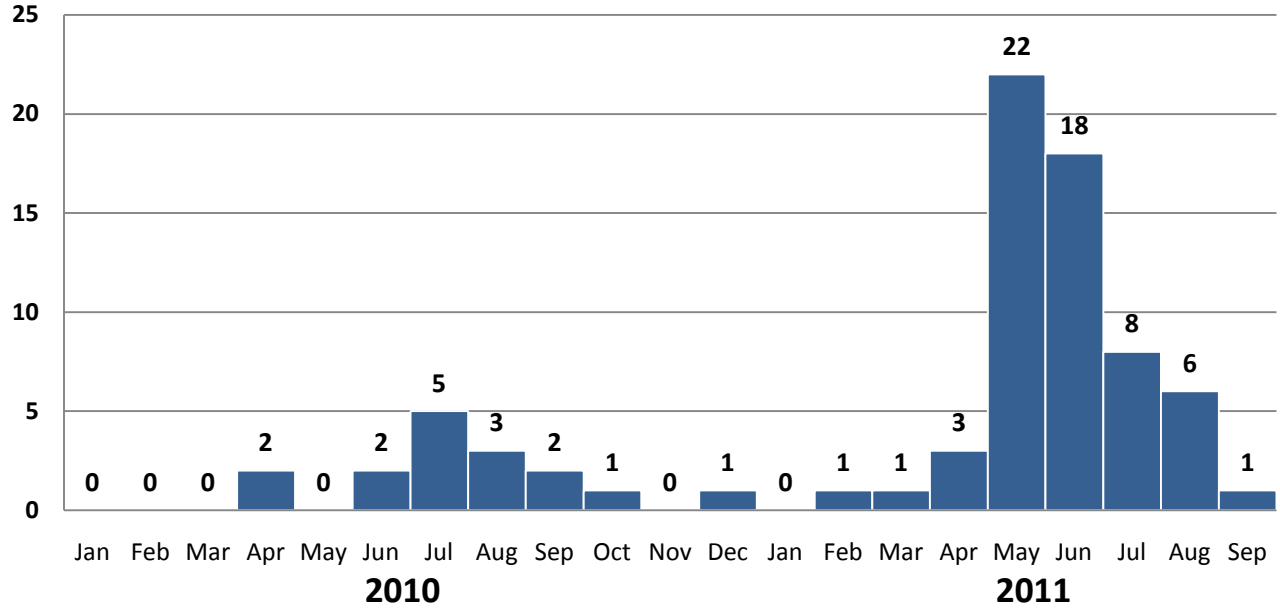
$40, based on a review of online retailers' product offerings. Firepots have commonly been sold through retailers of home and garden goods, including major chains. As noted, the products also have been (and are still) available from online retailers.

Firepots are products that only recently have been introduced as a consumer product in significant quantities. Archived web pages of what are believed to have been the market's top two firms indicate that the product was not marketed prominently until perhaps late 2009. This timeline is consistent with CPSC hazard data related to firepots and gel fuels, which show the first incident involving the products occurring in April 2010.[24] Chart 1 shows incidents involving gel fuels and firepots for 2010 and 2011. This information suggests that the use of firepots may have increased dramatically from 2010 to 2011. It also shows much greater use of the product in the late spring and summer months, suggesting that firepots are used mainly outdoors. Most of the incidents for which locations are known, in fact, have occurred outdoors, such as on a deck or patio. Based on information relating unit sales of gel fuel by a leading manufacturer to its sales of firepots, the Directorate for Economic Analysis estimates that nearly 2.5 million firepots could have been sold to consumers since the product was introduced. Most of these units likely were purchased in 2010, and within the first six months of 2011.

Chart 1. Firepot/Gel Fuel Incidents, by Month and Year*



Source: Directorate for Epidemiology, CPSC, September 22, 2011
* Excludes incidents involving wall-mounted gel fuel fireplaces

The Directorate for Economic Analysis has identified at least 10 companies that have manufactured firepots or have been wholesalers/private labelers of firepots. These firepots have

[24] David Miller, op. cit.

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been sold online or through retail outlets that market home and garden products. Most of the leading marketers of firepots have also marketed their own brands of gel fuels. Based on a review of company data available from ReferenceUSA, the leading firms in the firepot market have fewer than 20 employees, and they are categorized primarily as wholesalers. Under size guidelines issued by the U.S. Small Business Administration (SBA), wholesalers with fewer than 100 employees could be considered to be small businesses. Although the firms identified by the Directorate for Economic Analysis appear to have been among the leaders in the market, barriers to market entry are minimal, and many other firms could market products they manufacture or import.

Gel Fuels

Gel fuels analyzed by CPSC staff generally consisted of 80 percent or more alcohol content (ethanol and/or isopropanol) combined with water, gelling agents, and small amounts of other additives.[25] Staff from the Division of Chemistry in the CPSC's Directorate for Laboratory Sciences evaluated 18 alcohol-based fuels and found that their viscosities generally ranged from about 5,000 cP to 25,000 cP.[26] These viscosities are reportedly similar to those of blackstrap molasses (5,000 cP) or chocolate syrup (10,000 to 25,000 cP).[27]

Pourable forms of gel fuels intended for use in firepots have been sold in sizes ranging from one pint to one gallon, with one-quart containers apparently the most common size. Based on pricing information provided by firms, individual containers of pourable gel fuel generally retail in the range of $5 to $20 per unit. Some gel fuels are also sold in single-use cans that are intended for use in firepots or "personal fireplaces." These single-use cans range in size from about 3 to 7 ounces. Although firepots apparently have had a significant presence in the consumer market for just the last two years, at least one firm marketed a pourable gel fuel similar to those used in firepots for perhaps the last 10 years as fuel for gel fuel fireplaces. Gel fuels for fireplaces have been available in single-use cans at least since the middle 1980s. These products, which are typically sold in 13-ounce cans, are not intended to be poured, and they continue to be marketed by some firms, including firms that had been active in the market for firepots. Most of the manufacturers and private labelers of pourable gel fuels identified by CPSC staff did not offer them for sale until 2009 or later.

Information on unit sales of pourable gel fuels was provided by 11 of the firms that agreed to voluntary recalls of their products during 2011. These firms had combined shipments of about 2.5 million units since 2008. One firm accounted for nearly two-thirds of the total reported unit sales. A twelfth firm also agreed to a recall of its products, but information on its unit sales is not available. The Directorate for Economic Analysis has not identified other manufacturers of pourable gel fuels intended for use in firepots, although similar products marketed for other uses (such as fire-starters) are available from several other firms.

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[25] Scott Ayers, Fire Protection Engineer, ESFS. "Engineering Analysis of Gel Fuel Bottles/Containers," memorandum to Rohit Khanna, Project Manager, EXHR, November 2011.
[26] Matthew Roemer, Chemist, Division of Chemistry, Directorate for Laboratory Sciences, Gel Fuel Chemical Composition and other Relevant Properties," memorandum to Rohit Khanna, Project Manager, EXHR, November 2011.
[27] Research Equipment (London) Ltd., Viscosity Chart, http://www.research-equipment.com/viscosity%20chart.html.

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As noted previously, many of the leading firms that marketed gel fuels also have marketed firepots. Most of the firms are categorized primarily as wholesalers. Available information from ReferenceUSA indicates that all of the firms have fewer than 50 employees, which would categorize them as small businesses under SBA size guidelines.

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TAB I: Firepot and Gel Fuel Draft Federal Register Notice

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DRAFT 12-7-11

Billing Code 6355-01-P

CONSUMER PRODUCT SAFETY COMMISSION

16 CFR Part Chapter II

Fire Pots and Gel Fuel; Advance Notice of Proposed Rulemaking; Request for Comments and Information

AGENCY: Consumer Product Safety Commission.

ACTION: Advance notice of proposed rulemaking.

SUMMARY: The Consumer Product Safety Commission ("the Commission," "CPSC," or "we") has reason to believe that firepots and gel fuel used together may present an unreasonable risk of injury. As of September 30, 2011, the Commission is aware of 76 incidents that resulted in 2 deaths and 86 injuries involving firepots used with gel fuel. All of these incidents occurred between April 3, 2010 and September 1, 2011. Many of the injuries were severe; over half of the victims reportedly required hospitalization. This advance notice of proposed rulemaking ("ANPR") initiates a rulemaking proceeding under the Consumer Product Safety Act ("CPSA"). We invite comments concerning the risk of injury associated with firepots, gel fuel and gel fuel containers, the regulatory alternatives discussed in this notice, and other possible ways to address this risk. We also invite interested persons to submit an existing standard or a statement of intent to modify or develop a voluntary standard to address the risk of injury described in this notice.

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DATES: Written comments in response to this notice must be received by [**insert date that is 60 days after publication**].

ADDRESSES: You may submit comments**,** identified by Docket No. [**insert CPSC docket number**], by any of the following methods:

Electronic Submissions

Submit electronic comments in the following way:

Federal eRulemaking Portal: http://www.regulations.gov. Follow the instructions for submitting comments.

To ensure timely processing of comments, the Commission is no longer accepting comments submitted by electronic mail (e-mail), except through www.regulations.gov.

Written Submissions

Submit written submissions in the following way:

Mail/Hand delivery/Courier (for paper, disk, or CD-ROM submissions), preferably in five copies, to: Office of the Secretary, Consumer Product Safety Commission, Room 820, 4330 East West Highway, Bethesda, MD 20814; telephone (301) 504-7923.

Instructions: All submissions received must include the agency name and docket number for this rulemaking. All comments received may be posted without change, including any personal identifiers, contact information, or other personal information provided, to http://www.regulations.gov. Do not submit confidential business

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information, trade secret information, or other sensitive or protected information electronically. Such information should be submitted in writing.

Docket: For access to the docket to read background documents or comments received, go to http://www.regulations.gov.

FOR FURTHER INFORMATION CONTACT: Rohit Khanna, Fire Program Area Team Leader, Office of Hazard Identification and Reduction, Consumer Product Safety Commission, National Product Testing and Evaluation Center, 5 Research Place Rockville, MD 20850; telephone 301-987-2508, or e-mail rkhanna@cpsc.gov.

SUPPLEMENTARY INFORMATION:

A. Background

CPSC staff identified firepots used with gel fuel as an emerging hazard in June 2011, after a severe injury was reported to the CPSC. We pursued investigations and conducted analyses of these incidents. As of September 30, 2011, we are aware of 76 incidents involving firepots used with gel fuel that resulted in 2 deaths and 86 injuries. In an effort to address this emerging hazard, the CPSC's Office of Compliance and Field Operations initiated several recalls of pourable alcohol gel fuel. To date, 12 voluntary recalls have been announced recalling more than 2 million bottles of gel fuel. The products involved in the recalls were alcohol-based gel fuel in containers intended to be used with firepots. Each recalled product was marketed for use with firepots. We seek to

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establish a more permanent means to reduce or eliminate the hazard posed by firepots using gel fuel.

B. The Products

The incidents discussed in this ANPR all involve firepots used with alcohol-based gel fuel. When firepots and gel fuel are used together, they can present serious burn and fire hazards. Firepots and gel fuel are usually sold as separate products, but they are often marketed for use together, and some companies manufacture both products.

1. *Firepots*

This ANPR covers firepots that are designed and intended to be used with gel fuel. Firepots are portable, decorative lighting accents marketed for indoor and outdoor use. Their purpose is decorative. They provide some illumination and are not intended to provide heat. Many are made of ceramic material and look like vases or decorative pots, but some have different features and materials, such as a partial enclosure made of glass. Firepots are also sometimes called personal fireplaces, personal fire pits, firelights, or fire bowls. These products have the following characteristics in common. They: (1) are portable; (2) are open on at least one side; (3) have an open cup, usually made of stainless steel, to hold the gel fuel; and (4) are used with alcohol-based gel fuel. This ANPR does not cover stationary fireplaces or lighting products that have a wick or use a type of fuel other than alcohol-based gel fuel.

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Firepots are relatively new products. They were not prominently marketed until late 2009. Firepots range in price from under $20 to more than $100. Based on a review of online retailers' product offerings, most models are priced at $20 to $40. Based on information relating unit sales of gel fuel by a leading manufacturer to its sales of firepots, we estimate that nearly 2.5 million firepots could have been sold to consumers since the product was introduced. Most units likely were purchased in 2010, and during the first six months of 2011. We have identified at least 10 companies that have manufactured firepots or have been wholesalers/private labelers of firepots. These firepots have been sold online or through retail outlets that market home and garden products. Most of the leading marketers of firepots also have marketed their own brands of gel fuel. The leading firms in the firepot market have fewer than 20 employees, and they are categorized primarily as wholesalers. Under size standards issued by the U.S. Small Business Administration ("SBA"), wholesalers with fewer than 100 employees could be considered small businesses. Barriers to market entry are minimal, and additional firms could market firepots that they manufacture or import.

2. *Gel Fuel*

This ANPR also covers gel fuel that is designed and intended to be used as fuel for firepots. Gel fuel is composed primarily of alcohol, and it produces a clean-burning flame with no visible smoke or ash. CPSC staff analyzed 18 samples of firepot gel fuels to determine chemical composition, flash point, and viscosity. The analyses showed that

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firepot gel fuel is primarily alcohol-based (containing approximately 80 percent alcohol). The types of alcohol most commonly included were ethanol, isopropanol ("IPA"), and ethanol and IPA mixtures. The remaining components in the gel fuel samples were water, gelling agents, and additives, including citronella and eucalyptus. The analysis determined that the flashpoint for these samples was less than or equal to 74° Fahrenheit ("F"), with the lowest measure being 32° F. Gel fuel has a higher viscosity than liquid fuels. The analysis found that gel fuel viscosities ranged from 5,000 to 25,000 CentiPoise ("cP"). These viscosities are similar to those of molasses (5,000 cP) or chocolate syrup (10,000 to 25,000 cP).

Gel fuel intended for use with firepots has been sold in sizes ranging from one pint to one gallon, with one-quart containers apparently the most common size. Individual containers of gel fuel generally have sold at retail for $5 to $20 per unit. Although firepots have had a significant presence in the consumer market for the last two years only, at least one firm has marketed gel fuel similar to what is used in firepots for approximately the last 10 years to be used as fuel for gel fuel fireplaces. Gel fuel for fireplaces has been available in single-use cans since at least the middle 1980s. These products continue to be marketed by some firms, including firms that had been active in the market for firepots. Gel fuel also is available in single-use cans that can be placed in the firepot. Single-use cans of gel fuel intended for use with firepots are covered by this ANPR. Most manufacturers and private labelers identified by CPSC staff who offer gel

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fuel in bottle containers did not offer it for sale until 2009 or later.

Information on unit sales of gel fuels was provided by 11 of the firms that agreed to voluntary recalls of their products during 2011. These firms had combined shipments of about 2.5 million units since 2008. One firm accounted for nearly two-thirds of the total reported unit sales. A twelfth firm also agreed to a recall of its products, but information on its unit sales is not available. Available information indicates that the firms would be considered small businesses under SBA guidelines.

C. The Risk of Injury

1. *Incident Data Overview*

As of September 30, 2011, we are aware of 76 incidents involving firepots that were using gel fuel. These incidents resulted in 2 deaths and 86 injuries, a majority of which resulted in severe burns that reportedly required hospitalization. The incidents occurred between April 3, 2010 and September 1, 2011. A majority of the reported incidents (as well as a majority of the injuries and both fatalities) occurred when a consumer was pouring more fuel into a firepot (referred to as "refueling"), resulting in an explosion. This and other hazard scenarios are discussed in section C.2 of this preamble. Many injuries were severe. Of the 86 injury victims, 48 of them (56%) were hospitalized. Many victims who were not hospitalized received treatment in emergency rooms for their burn injuries. Most (53) of the incidents involved 1 victim, but 9 had no victims, and 14 had multiple victims.

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The two fatalities were a 51-year-old man and an 84-year-old woman. Of the 86 nonfatal injury victims, 19 were victims of unknown age. Among the 67 injury victims whose age is known, 1 was under 5 years of age, 7 were between ages 5 and 14, 12 were between ages 15 and 29, 39 were between ages 30 and 49, 7 were between 50 and 64, and 1 was older than 64.

2. *Hazard Scenarios*

From the reported incidents, we identified eight hazard scenarios associated with firepots using gel fuel. The most common hazard scenario involves refilling the firepot with gel fuel. The eight identified hazard scenarios are discussed below.

Refueling firepot. The majority of incidents, the majority of high severity injuries, and both deaths reported to date, occurred when consumers were attempting to refill a firepot that had just recently been in use. In 49 incidents (64 percent of all reported incidents), consumers were reportedly in the process of, or had just finished, refilling a firepot when the flame in the firepot ignited the vapors in the fuel container and an explosion resulted. These 49 incidents caused 2 fatalities and 61 injuries, 35 of which were high severity burns needing hospitalization. In 36 of the 49 refueling incidents, the most seriously injured person was not the person who was refilling the firepot. Details on the extent of the burns frequently are missing for the hospitalized cases, but at least nine victims of this scenario reportedly sustained between 20 to 70 percent total body surface area ("TBSA") burns. In 26 of these 49 incidents, consumers reported that they believed

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the firepot had run out of fuel because they did not see any flames in the firepot. In 6 of these 49 incidents, consumers reported that a low flame was present in a nearly empty firepot.

For example, in one incident, a 51-year-old man sustained 60 percent TBSA burns and died after being hospitalized for 33 days. His wife also was hospitalized with serious burns. According to the incident report, "His wife was sitting at the table as he was pouring the fuel. Suddenly there was an explosion and the husband, wife, lanai, plants, clothing. etc., were all on fire." Flaming gel fuel was dripping from the top of the lanai onto the victims and patio.

According to another refueling incident report, a firepot was at the center of a patio table and had been burning for nearly two hours. The four people present believed that the flame had gone out. One began to pour more gel fuel into the burn cup. According to the incident report, "Once the bottle was tilted in a direction to pour the gel fuel, a fireball erupted. The fireball appeared to come from outside the bottle and above the gel burner. The 'explosion' knocked the victim backwards out of her chair where she laid with parts of her upper body on fire." The victim was hospitalized (including three nights in the intensive care unit) and released with second-degree burns on 10 percent of her body—on her face, arms, chest, stomach, and back. The person pouring the gel fuel suffered minor burn injuries.

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Explosion while lighting firepot. In five incidents (about 7 percent) an explosion occurred in the firepot, which already had fuel in it, when the consumer attempted to light the firepot with an open-flame ignition source (such as a match or lighter). These incidents resulted in nine injuries, four of which were high severity burn injuries needing hospitalization. According to the incident reports, in three cases the firepot had already been in use that day and was being relit having just been refilled. In two cases, it was not clear whether the firepot had previously been in use that day.

Fuel container explosion. In two incidents (about 3 percent), the gel fuel container was a short distance away from a lit firepot when the container exploded. In both incidents, the victims were hospitalized, one with high severity burn injuries. In one incident, the consumer reportedly poured the fuel from a gallon jug into a ceramic firepot, lit it with a long BBQ lighter, and placed the jug of fuel a foot away when the jug of fuel ignited and exploded. A 50-year-old female was injured and hospitalized. In the other incident, the 25-year-old victim reported: "We poured (brand X) fuel gel into our fire pot and lit it. We sat the bottle of gel about a foot away from the pot. (We don't remember if the top was on or off the bottle.) All of the sudden, the bottle exploded. The gel that passed over the open flame of the pot ignited and landed on me. (It sounded like a gunshot.) The flash sunburned my face, synged (*sic*) my eyelashes, and burned my left ear. It caught my left arm, back, hair and shirt on fire." Engineering analysis of these incidents suggests that it was likely that a small flame was present on the bottle after

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refueling of the firepot, which could have ignited the flammable vapors in the fuel container.

Burn cup ejection. In six incidents (about 8 percent), reports stated that the burn cup ejected spontaneously from the firepot during use. These incidents resulted in three injuries, one of which required hospitalization. Although we could not replicate this scenario in laboratory testing, we believe that the burn cup ejections may be caused by excessive pressure that builds up due to inadequate venting in the interior of the firepot.

Explosion during use. In four incidents (about 5 percent), reports stated that fuel in the burn cup exploded spontaneously while the firepot was in use. Single victims were injured in three of these cases, with one victim, a 5-year-old boy, reportedly hospitalized for four days for burn injuries to his face, eyes, and chest. In another incident, a dog was set on fire; it ran into the house, causing a fire and substantial property damage. We could not replicate this scenario in laboratory testing, but we believe that fuel explosions may be due to exposure to contaminants.

Tip over of firepot. In three incidents (about 4 percent), lit firepots tipped over, causing burning gel fuel to spill. These incidents resulted in six injuries, four of which were high severity burn injuries requiring hospitalization. Two of the victims were young children. In these scenarios, the firepot was placed on a surface, such as a table or stool, when a person bumped into the supporting surface or accidentally knocked over the firepot, causing the burning gel fuel to fall onto the victims.

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Firepot breakage. In three incidents (about 4 percent), the firepot reportedly broke while it was in use. In one incident it was reported that when the firepot broke, ceramic shards went flying. These incidents did not result in injury. We did not observe this scenario in our laboratory testing. However, it is possible that the temperature and internal pressure generated during use of the firepot could cause the ceramic firepot to break.

Explosion while extinguishing flame. In one incident, a consumer reported that when she attempted to extinguish a firepot using the snuffer device that was supplied with the firepot, a flame erupted and flaming gel spurted up to five feet away. The burning gel ignited furniture and carpeting, causing property damage but no injuries. This scenario also was not observed in laboratory testing.

Not enough information. In three incidents, not enough information was available to classify the hazard pattern. These incidents resulted in three injuries, one requiring hospitalization.

3. *Details Concerning Injuries*

Injuries resulting from these incidents can be extensive and life-threatening, requiring lengthy, costly, and painful treatment. Burn injuries are classified by the depth of tissue that is burned, which is expressed as the degree of burn (first-, second-, or third-degree). Burn severity is a function of the victim's age, the depth of burn, the extent of burn (generally expressed as the percentage of total body surface area that has second- or

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third-degree burns), and by the specific location of the burned area(s). Certain areas of the body are considered to be critical areas (face, ears, hands, feet, joints, genitals, and perineum). As a general rule, any injuries involving second- or third-degree burns in critical areas, and/or >20 percent TBSA, are considered high severity and require hospitalization.

The reported injuries range from minor to high severity, and two victims are known to have died from their severe burns. Surviving victims of firepot incidents may require life-support and medical treatment in intensive care units. Detailed information is not available for all hospitalization cases involving high severity injuries, but we are aware of at least 15 hospitalized victims who were admitted for extensive periods (from 10 to 76 days based on the most recent update of each specific case). Eleven cases specifically noted that between 20 to 70 percent of the total body surface area was burned. Victims may require multiple surgeries, including skin grafts, and they may be at risk from complications, such as shock, fluid loss, and infection. In addition, victims may be left with extensive deep scarring, permanent disfigurement and functional impairment, and severe psychological trauma, especially if the face is involved.

D. Analysis of Hazards Posed by Firepots and Gel Fuel

Firepots used together with gel fuel create a serious hazard that consumers may not perceive accurately. Various characteristics of both firepots and gel fuels may be

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responsible for this. We have analyzed the incidents and samples of the products to understand these hazards better.

1. *Firepots*

a. *Physical Characteristics*

Firepots have certain physical characteristics that our analysis indicates could contribute to the hazard reported in these incidents. All firepots subject to this ANPR have an open receptacle, referred to as a "burn cup," to hold gel fuel. The burn cup is usually made of stainless steel or ceramic material. It has no covering. If the firepot falls or is knocked over, the burning gel fuel can spread onto people or combustible items. Unlike candles, oil lamps, or other outdoor lighting accessories that require a wick to produce a flame, firepots do not need a wick to sustain a flame; so when a firepot is knocked over, the fuel and fire will spread readily.

Firepots are available in a variety of shapes and sizes. The geometry of some may make them more likely to tip over if the firepot, or the surface on which it sits, is bumped accidentally. We conducted tests of several tip-over scenarios. In these tests, when firepots placed on a flat surface were tipped, fuel was ejected up to 5 feet. When firepots were positioned on heights simulating placement on a table or bar, as reported in the incident data, a firepot falling from a 31-inch height splattered fuel approximately 5 feet, and falls from a 42-inch height splattered fuel about 9 feet. Consumers are not likely to

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anticipate the significant distance that gel fuel can spatter. We are aware of three firepot tip-over incidents injuring six victims in which four victims were hospitalized.

The burn cup sits within the firepot and is not secured to the base of the firepot by any means. We are aware of six incidents in which the burn cup ejected from the firepot. Staff did not observe this scenario in laboratory testing. One possible explanation for this scenario is that while the firepot is in use with the gel fuel, it reaches very high temperatures, which produces increased pressure within the firepot. This build up of pressure, without adequate venting, may cause the burn cup to eject.

b. *Warnings and Use*

We examined 11 samples of firepots to assess the warnings provided with the products and to consider hazards related to how consumers are likely to use firepots. Most of the firepots that we examined have a warning directing the consumer not to leave a burning firepot unattended and to keep it away from children and pets. Some firepots instruct the user to place the firepot on a flat and level surface only. Most of the firepots that we examined had a warning directing the user not to add fuel to an open flame and to check that the flame is out before refueling.

These warnings were usually on the package or in the instructions enclosed in the package. One sample had the warning on the product, but it was not affixed permanently and would be removed by the consumer before using the firepot because the warning blocks the burn cup. None of the samples had permanent warnings about refilling that

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could be noticed each time the product is used. We believe that the warnings we examined are not likely to be effective. They were not conspicuous due to their placement, lack of visual differentiation, and lack of pictorial symbols. Moreover, only one warning label clearly stated that the consequence of not following the warning was severe burns.

Consumers may not observe and follow warning labels on or accompanying firepots, even if the warnings are present. In general, the safer a product is perceived to be, the less likely people are to read the instructions and warnings that accompany it. Also, the more familiar people are with a product, the less likely they are to read instructions and warnings. Firepots appear to be simple and familiar decorative accessories that are easy to use. They may resemble familiar and less hazardous products, such as candle holders. In addition, it may be difficult for consumers to comply with a warning not to refill the firepot while it is still hot or burning. As discussed in section D.2.a. of this preamble, gel fuel produces a nearly invisible flame that consumers may not detect. In 26 of the 49 incidents that reportedly occurred while a consumer was refilling a firepot, consumers reported that the flame was out, that there were no visible flames, or that no gel fuel was left in the firepot. In 10 of the refilling incidents, consumers acknowledged that the flame was low, the pot was hot, or that there was a small amount of gel fuel left in the pot before they refilled it. In these situations, consumers may be refilling the firepots because they are not sufficiently knowledgeable about the behavior

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of alcohol-based fuels, and they identify firepots with familiar and less hazardous products.

2. *Gel Fuel*

a. *Physical and Chemical Characteristics*

We examined the physical and chemical properties of 18 samples of gel fuel to evaluate how these characteristics may contribute to the firepot incidents that have been reported. The gel fuel samples that we analyzed were composed primarily of alcohol (approximately 80 percent alcohol with the balance being water, gelling agent, and additives like citronella). Most contained ethanol and/or IPA. Gel fuel is flammable. According to regulations under the Federal Hazardous Substances Act ("FHSA"), a substance is considered flammable if it has a flashpoint above 20° F and below 100° F. 16 CFR 1500.3(c)(6)(ii). The flashpoint for the samples that we examined was less than or equal to 74° F. (Two samples that contained butane had flashpoints of 32° F and 36° F.) Under a widely recognized classification system, gel fuel would also be considered a Class 1 Flammable Liquid. *See* National Fire Protection Association ("NFPA") 30, *Flammable and Combustible Liquids Code*, Chapter 4.

Gel fuel produces a clean-burning flame and generates very little smoke or soot. This makes the flame less visible than flames produced by other types of fuel, particularly if it is burning during daylight. Moreover, as the gel fuel in the burn cup burns, the flames become more obscured in the bottom of the cup. A small flame or smoldering

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combustion of the spent gel fuel may remain in the base of the burn cup when the fuel is almost exhausted. This can mislead consumers into thinking that the firepot's flame is out and needs more fuel. If the consumer adds fuel to the firepot when there is a small flame or smoldering combustion in the burn cup, the gel fuel can easily ignite.

Gel fuel has a higher viscosity than liquid fuels, such as gasoline or kerosene. Its consistency is similar to molasses or honey. This higher viscosity means that a pool of spilled gel fuel will not spread as widely as a less viscous liquid. However, the higher viscosity increases the risk of injury with these burning fuels. Most incidents involved burning gel fuel that contacted victims when the fuel exploded, was ejected, or spilled. Due to its viscosity, burning gel fuel, when it contacts skin or clothing, sticks to that surface more than liquid fuel. Burning gel fuel is difficult to extinguish with the usual methods used to put out a fire. The reaction that most individuals would have when they are on fire would be to "stop, drop, and roll." However, this maneuver is ineffective because patting the flaming gel fuel actually spreads the burning surface. Using water to extinguish a gel fuel fire also is not likely to be effective because, to be successful, a significant amount of water would be needed, and initially pouring water on the fire is likely to spread the burning gel fuel over a larger surface area.

b. *Characteristics of Gel Fuel Containers*

Most of the reported incidents occurred when a consumer was in the process of pouring more gel fuel into a firepot that was, or recently had been, in use. We examined

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the gel fuel containers and assessed how the combination of the properties of the gel fuel and characteristics of the gel fuel containers may contribute to the risk of injury in these incidents.

In the majority of incidents, consumers reported "explosions" and/or ejecting of burning alcohol fuel during refilling, or bottles "exploding" after refilling. These phenomena can be explained by understanding the chemistry within the vapor space (also called the "headspace") of the bottle. The headspace is the area inside the container that is above the level of the fuel in the container. With alcohol-based gel fuel at room temperature, the concentration of the alcohol vapors in the headspace is above the lower flammable limit ("LFL") and below the upper flammable limit ("UFL"). This means that, at room temperatures, there is an explosive concentration within the alcohol fuel bottle headspace. When exposed to an open flame, this atmosphere will cause an explosion and eject burning fuel. For this to happen, the bottle must have a sufficient amount of gaseous headspace but still have a substantial amount of fuel remaining. The amount of gaseous headspace governs the energy of the explosion, which then ejects the remaining gel fuel. If the bottle is in an orientation where fuel is near the bottle throat and a flame is able to penetrate into the headspace igniting the explosive atmosphere, an explosion can occur, which rapidly increases the pressure inside the bottle and ejects the remaining liquid or gel fuel, igniting it as it exits. Testing at CPSC has confirmed this scenario.

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Most gel fuel containers are open-mouth containers that resemble water bottles or containers used for storing cleaning liquids. They do not have safety features, such as venting, grounding, or flame arrestors to prevent ignition of flammable vapors. Furthermore, while a majority of the incidents involved refueling, there are incidents, such as tipovers, can ejections and explosions, that would not be addressed by requiring safety features on the gel fuel containers.

c. *Warnings and Use of Gel Fuel*

As noted, gel fuel is flammable. Under the FHSA, it is required to have labeling that warns of the flammability hazard. 15 USC 1261(p). Almost all of the gel fuel samples we examined complied with the warning label requirements of the FHSA. However, we found that these warnings do not effectively address the hazards posed by gel fuel. As with the firepot warnings, the gel fuel warnings are not conspicuous. The majority of gel fuel bottles that we examined warn against refilling a firepot. However, this warning is only one element in a long list of directions for use or that is included in the list of generic warnings, such as: "keep away from children" or "never leave a burning fire pot unattended." The refilling warnings are not differentiated from other statements on the containers, and they do not have any pictorial symbols. None of the warnings state the consequence of refilling a firepot while it is hot or burning.

As with firepots, consumers are not likely to perceive the hazard posed by gel fuel. Gel fuel containers often are packaged in containers that look familiar, resembling

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water bottles. They do not have any special closures, such as child-resistant packaging, that might alert a consumer to the potential hazard. The containers may have phrases such as "environmentally friendly," "eco-friendly," "live safe, burn safe," and "non-toxic" that may reduce the likelihood that a consumer would consider the substance to be hazardous. This may lead consumers to ignore warnings on the product.

E. Relevant Statutory Provisions

We are conducting this proceeding under the Consumer Product Safety Act ("CPSA"). 15 U.S.C. 2051 *et seq.* Firepots and gel fuel are consumer products. *Id*. 2052(a)(5). Under section 7 of the CPSA, the Commission can issue a consumer product safety standard if the requirements of such a standard are "reasonably necessary to prevent or reduce an unreasonable risk of injury associated with [a consumer product]." *Id.* 2056(a). Such a standard must be expressed in terms of performance requirements or requirements for warnings or instructions. *Id.* Under section 8 of the CPSA, the Commission can issue a rule declaring a product to be a banned hazardous product when the Commission finds that a consumer product is being, or will be, distributed in commerce and there is no feasible consumer product safety standard that would adequately protect the public from the unreasonable risk associated with the product. *Id.* 2057.

Section 9 of the CPSA sets out the procedure that the Commission must follow in order to issue a standard or a banning rule. The rulemaking may begin with an ANPR

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that identifies the product and the nature of the risk of injury associated with the product, summarizes the regulatory alternatives being considered by the Commission, and provides information about any relevant existing standards and a summary of the reasons the Commission believes they would not eliminate or adequately reduce the risk of injury. The ANPR also must invite comments concerning the risk of injury and regulatory alternatives and invite submission of an existing standard or a statement of intent to modify or develop a voluntary standard to address the risk of injury. *Id.* 2058(a). The next step in the rulemaking would be for us to review comments submitted in response to the ANPR and decide whether to issue a proposed rule along with a preliminary regulatory analysis. The preliminary regulatory analysis would describe potential benefits and costs of the proposal, discuss reasonable alternatives, and summarize the potential benefits and costs of the alternatives. *Id.* 2058(c). We would then review comments on the proposed rule and decide whether to issue a final rule along with a final regulatory analysis. *Id.* 2058(d)-(g).

F. Relevant Existing Standards

We are not aware of any existing mandatory or voluntary standards that would address the risk of injury associated with firepots and gel fuel. Other federal agencies have regulations concerning Class I flammable liquids. For example, the U.S. Department of Transportation ("DOT") sets out certain requirements for storage and transportation of these substances. *See, e.g.*, 49 CFR parts 172 through 177. The

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Occupational Safety and Health Administration ("OSHA") regulates these substances in the workplace. 29 CFR 1910.106. These regulations do not establish any requirements related to the risk of injury identified in the reported incidents. NFPA 30, *Flammable and Combustible Liquids Code,* is a voluntary standard concerning classification, storage, and handling of flammable and combustible liquids. It does not directly address the firepot- gel fuel incidents. However, some of the provisions concerning containers for storing flammable liquids could provide guidance for requirements for gel fuel containers.

G. Regulatory Alternatives

We are considering the following alternatives to address the risk of injury associated with firepots and gel fuel:

1. *Mandatory standard.* We could issue a rule establishing performance requirements for firepots and/or gel fuel to prevent or reduce an unreasonable risk of injury associated with these products. For example, possible performance requirements for firepots might include stability requirements to address the tip-over hazard. Possible requirements for gel fuel might include performance requirements for flame visibility to increase consumers' awareness of the presence of a flame. To address the refueling hazard, one option may be requirements for gel fuel containers to prevent ignition of the flammable headspace or to require venting of the container.

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2. *Mandatory labeling rule*. We could issue a rule setting requirements for labeling and/or instructions for firepots and/or gel fuel if we found that such warnings and instructions could sufficiently reduce the risk of injury identified in the reported incidents.

3. *Voluntary standard*. If we determined that a voluntary standard was adequate to address the risk of injury associated with firepots and gel fuel, we could defer to the voluntary standard in lieu of issuing a mandatory rule.

4. *Banning rule.* We could issue a rule declaring firepots and/or gel fuel to be banned hazardous products if we found that no feasible consumer product safety standard would adequately protect the public from the unreasonable risk of injury associated with these products.

5. *No regulatory action*. We could take no regulatory action, but continue to rely on corrective actions under section 15 of the CPSA to address the risk of injury associated with firepots and gel fuel.

H. Solicitation of Information and Comments

This ANPR is the first step of a proceeding that could result in a mandatory rule for firepots and gel fuel. We invite interested persons to submit comments on any aspect of the alternatives discussed above.

In accordance with section 9(a) of the CPSA, we also invite comments on:

1. The risk of injury identified by the Commission, the regulatory alternatives being considered, and other possible alternatives for addressing the risk.

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2. Any existing standard or portion of a standard that could be issued as a proposed regulation.

3. A statement of intention to modify or develop a voluntary standard to address the risk of injury discussed in this notice, along with a description of a plan (including a schedule) to do so.

In addition, we invite comments and information concerning the following:

1. What products should we include in or exclude from the rulemaking? For example, gel fuels tend to use ethanol, isopropanol, and ethanol and isopropanol mixtures. Specifying the type of alcohol used in gel fuel would provide clarity as to the scope of any rule on gel fuel. However, if a gel fuel manufacturer could substitute a different alcohol or chemical for ethanol or isopropanol, a rule that was specific with respect to the type of alcohol used might then be inapplicable.

2. What possible warnings or instructions for firepots and/or gel fuel could address the risk of injury?

3. What possible performance requirements for firepots, gel fuel, and/or gel fuel containers could address the risk of injury? Examples of possible performance requirements are a stability test for firepots making them less likely to tip over or a flame visibility test for gel fuel so that the flame would be more apparent.

4. What are the potential costs to manufacturers of labeling or performance requirements?

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5. What are the potential benefits of a rule that would require warnings or instructions?

6. What are the potential benefits of a rule that would establish performance requirements for firepots, gel fuel, and/or gel fuel containers?

7. What is the potential economic impact of banning firepots and/or gel fuel? What alternative products would remain available?

8. What is the potential impact of a rule on small entities?

9. What other uses exist for pourable gel fuels other than the firepots covered by the ANPR and the fireplaces that are expressly not covered by this ANPR?

10. Should pourable gel fuels ever be allowed to be used in open containers or open flame applications that might allow for spillage or splattering of gel fuels?

Dated: _____

_____
Todd A. Stevenson, Secretary
Consumer Product Safety Commission

THIS DOCUMENT HAS NOT BEEN REVIEWED OR ACCEPTED BY THE COMMISSION.

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