Petition CP 11-1

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May 23, 2011

Mr. Todd Stevenson, Director
Office of the Secretary
U.S. Consumer Product Safety Commission
4330 East-West Highway
Bethesda, MD 20814

Re: Petition for a Standard for Gas Fireplaces

Dear Mr. Stevenson:

I am filing this petition to request the Consumer Product Safety Commission (CPSC) initiate rulemaking to require safeguards on glass fronts of gas fireplaces. Presently, the ANSI voluntary standard for Gas Vented Fireplaces permits gas fireplace glass fronts to reach temperatures of 500 degrees Fahrenheit. Momentary contact with a glass of that temperature causes the skin to immediately melt onto the glass. Glass fronts are accessible, touchable surfaces, particularly for small children, due to their positioning near the ground. Thousands of young children have been burned after contacting the hot glass of a gas fireplace.

I am a Human Factors Psychologist, having worked in the field of consumer product safety since 1982. From 1988 through 1993, I was employed by the CPSC in the Human Factors Division. Since 1994, I have been working independently as a human factors consultant. I have published in the field of Human Factors, including papers on product hazards, child supervision, warning label design, and voluntary standards. I have presented my findings at professional and industry conferences.

Last year, I was retained as an expert witness in a lawsuit filed on behalf of 11-month-old Marin Montgomery who suffered painful and disfiguring third burns after contacting the glass front of a gas fireplace. Marin lived with her mother and siblings in a rental apartment that had a gas fireplace in the living room. The fireplace glass was flush with the wall and positioned near the ground. Marin had been sitting on the living room floor with her mother who had just finished wrapping holiday gifts. Marin got up and toddled in the direction of the gas fireplace, which had been on for a period of time. Unbeknownst to her mother, the fireplace glass had reached a temperature of around 400° F.

Marin, who had just started walking, tripped & fell forward. Although her mom reached to grab her, the little girl had already stumbled and fallen against the vertical surface in front of her – the glass of the gas fireplace. Her mother immediately removed Marin from the glass, but it was too late. Her daughter's injuries were immediate. She suffered 3rd degree burns to both palms and scarring burns to her nose & forehead.

As it turns out, Marin's experience is not uncommon. The Consumer Product Safety Commission's (CPSC, 2009) National Electronic Injury Surveillance System (NEISS) database estimates that from 1999 through March 2009, over 2000 children aged 0-5 years suffered burn injuries on gas fireplaces. All incidents reported that the child fell into, backed into, or otherwise contacted the fireplace. Most specifically mentioned contact with the glass. Hands were the part of the body most frequently injured. However, there were a number of reports of arm, finger, lower trunk and facial injuries as well.

Product Description, Instruction & Warnings

The gas fireplace in Marin's home is called *direct vent* because the decorative glass front is fixed and cannot be opened to allow heat to escape. This causes the glass itself to absorb enormous heat. In fact, the industry standard for Vented Gas Fireplace Heaters (ANSI, 2003) allows glass fronts to reach temperatures of 500 degrees F.

A warning in the product's Installation & Operation Manual advises consumers of the high surface temperatures and to "...stay away to avoid burns or clothing ignition." Further, parents are advised to carefully supervise young children when they are in the same room as the appliance. Optional screen guards, available for purchase, are noted in the manual.

A warning tag about this hazard was placed on the fireplace itself:

"CAUTION: Hot while in operation. Do not touch. Severe burns may result.
Keep children, clothing, furniture, gasoline and other liquids having flammable
vapors away."

This warning tag is attached to the pilot light which is located beneath the fireplace, and behind an access door.

Burn Potential & Hot Surfaces

Information about the burn potential of hot surfaces was published in the 1940s by Henriques and Mortiz of the Harvard Medical School. Their research showed a temperature-time relationship for burns (Mortiz and Henriques, 1947; Henriques, 1948). Through their research, they determined the following:

> The level of skin damage to the duration and intensity of surface contact
> can be related by the following curve (Fig. 1). Exposures below the lower

curve should not produce permanent injury in normal humans. Exposures between the curves are described as second-degree burns and have intermediate levels of cell damage. Exposures at levels above the top line are defined as third-degree burns that cause deep, permanent cell damage and scarring (ASTM C1055-03, p. 7).

The graph depicted in Figure 1, below, shows the Temperature-Time Relationship for Burns. According to this graph, complete transepidermal necrosis (cell death) occurs after 1 second at temperatures above 158 ° F (70°C).

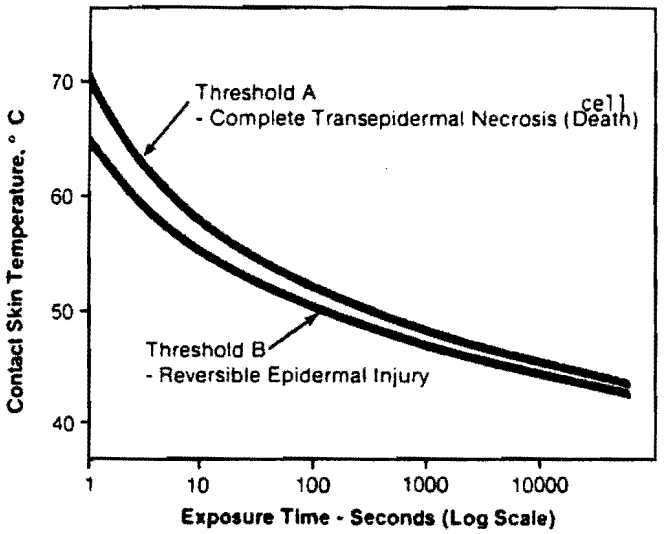

FIG. 1 Temperature-Time Relationship for Burns
ASTM C1055-03, Standard Guide for Heated System Surface Conditions that Product Contact Burn Injuries, ASTM International

Voluntary Standards and Surface Temperature Limits

A number of voluntary standards have incorporated the findings of Henriques & Moritz. *ASTM Standard Guide for Heated System Surface Conditions that Product Contact Burn Injuries* (C 1055-003) states that the maximum level of injury recommended is that causing first degree burns in the *average* subject. "At no time, however, are conditions that produce third degree burns recommended." The standard recommends surface temperatures below 158 degrees F.

The standard also cites the work of Stoll, Chianta and Piergallini (1979) who examined the relationship between pain, reaction times, and injury and established a minimum time to sense pain and react to it at any temperature to be a minimum of 0.3 s. Wu (1977) "...recommended that a 1-minute exposure limit be used for design purposes for persons who have slow reactions (infants, elderly, or

infirmed) or who *freeze* under severe hazard conditions."

According to the Underwriters Laboratories *Standard for Household Electric Ranges* (2005), the maximum acceptable temperature of glass surfaces as measured by a probe is 172°F. Temperature limits are increased 31°F for areas that will be more than 3 feet above the floor level, as installed.

Two British Standards address hazards of hot, touchable surfaces. The British Standard EN 563 (1994), *Safety of machinery – Temperatures of Touchable Surfaces – Ergonomics Data to Establish Temperature Limit Values for Hot Surfaces* states that the burn threshold for contacting glass for a time of 0.5 seconds is between 183.2° and 194° F.

British Standard EN 13202 (2000), *Ergonomics of the Thermal Environment. Temperatures of touchable hot surfaces - Guidance for Establishing Surface Temperature Limit Values in Product Standards with the Aid of EN 563,* instructs a protocol for determining hazardous touchable surfaces and the risk they pose (pp.6-7). First, identify all accessible, touchable hot surfaces. Next, perform a task analysis that identifies the activities involved in using the product. "Particular attention shall be paid to possible intentional and unintentional contact with hot surfaces and to which persons (users of the product and others) it may occur" (p. 6). Next, hot surfaces are measured during normal operating conditions of the product. "If the surface temperature is above the burn threshold, cutaneous injury upon contact with the hot surface is to be expected" (p. 6).

The standard specifically mentions "unintentional contact" by children (p. 8), instructing that extended reaction time is expected with children, so at least 4 seconds is used to calculate the minimum contact period. For younger children, this time will be longer: "Until 24 months children do not have reflexes which are quick enough to remove their hands from what burns them. They do not always have the ability to get away from hot surfaces therefore. The contact period can be up to 15 s for very young children."

Studies of Pediatric Burns on Glass Fronts of Gas Fireplaces

Medical professionals who have treated children with severe contact burns resulting from contact with gas fireplaces provide insight into the hazard pattern. Becker and Cartotto (1998) reported on an 11-month-old boy who sustained burns to his hand after touching the glass front of a gas fireplace. The child's parents had turned off the fireplace approximately five minutes prior to the accident.

The authors conducted experiments whereby they measured the glass temperature of three gas fireplace models. The maximum measurable temperature for one glass front was 254 ° C (489 ° F); the temperature was still increasing, however, the adhesive metal tape melted, preventing further measurements. Within an average of 6.5 minutes, the other fireplaces reached 392° F. Further, an average of 12.3 minutes was required for the appliances to cool from 392° F to 212 ° F. One unit was cooled to 122° F, which required 27.5 minutes (p. 87).

Based on their findings, the authors reported, that a "...a partial-thickness burn could occur with less than one second of contact with the glass front of a gas fireplace that had reached a maximum steady

state temperature. Additionally, less than one second would be required for a partial thickness burn five minutes after the fireplace had been extinguished."

Dunst, Scott, Kraatz, Anderson, Twomey, and Peltier (2004) reported seeing "an alarming increase in the incidence of pediatric palm burns associated with gas fireplaces." A retrospective chart review was conducted to identify patients under five years who sustained hand burns after contacting the glass of a gas fireplace. From January 1996 through December 2002, 39 patients ranging in age from seven to 23 months were identified (mean age was approximately 13 months). This represented a 15-fold increase in pediatric burns associated with gas fireplace glass contact since 1996. Furthermore, "...this increase is strongly correlated with an increase in the sales of glass-enclosed gas fireplaces during the same period" (p. 69).

Zettel, Khambalia, Barden, Murthy, and Macarthur (2004) identified 27 children who presented to The Hospital for Sick Children in Toronto between 1999 and 2002 due to gas fireplace contact burns. The children ranged in age from eight to 36 months (median age was 14 months). More than one-third of victims (37%) were injured after their lost their balance near the fireplace; another 30 percent were injured when they touched the glass front out of curiosity. Remaining injuries resulted from the child walking too close to the glass front.

Naqui, Enoch and Shah's (2005) retrospective data analysis identified 35 pediatric cases of contact burns from glass plates of gas fireplaces at a hospital in Manchester, England between 1994 and 2001. Most injuries involved the hand, palm or fingers. Other injuries affected the forearm, face, buttocks or thighs. All cases were accidental.

> Naqui, et. al. cited the study by Moritz and Henriques which indicated that: "... a temperature of 70° C [158° F] would cause a partial thickness burn in less than one second. Normal reaction time to a painful stimulus is .25s in a healthy adult...but this is obviously delayed in those with restricted mobility like toddlers. With glass plates of gas fires reaching temperatures of 245° C [473° F] within 15 min...., toddlers would have an extremely high risk of sustaining burn injury from such devices (2005, p. 74).

Human Factors Issues relating to Burns on the Glass from Gas Fireplaces

The hazard posed by gas fireplaces is due to a combination of factors including the high surface temperature of the fireplace glass, the accessible location of the glass front, the attractiveness of fire to young children, and the lack of consumer awareness of the hazard.

Fireplaces are situated in a family room or other communal areas of the home, approximately 6 inches from the floor. As was the case in Marin's home, they can cover an area of about 35 x 35 inches.

The low height of the fireplace glass makes it accessible to young children. Toddlers, who are

unsteady on their feet, are particularly vulnerable to inadvertently falling into or contacting the glass. This bears out in pediatric data that shows that the average age of victims was about 13-14 months Dunst, et. al. (2004) and Zettel, et. al. (2004). Most children walk independently between 10 and 15 months of age and are considered to be "toddlers" for about a year as they learn to become steady on their feet. Children this age frequently lose their footing when walking or standing. A toddler who is walking near the wall where the fireplace is positioned, may, foreseeably, fall against it.

The fireplace, when built into the wall and flush with it serves as a physical substitute for the section of wall that it replaces. Toddlers range in height from about 28-29 inches. If a child were toddling near the subject fireplace, his or her hands and other parts of the body would surely contact the glass, as occurred in more than 2,000 incidents in the last 10 years.

Aside from unintentional contact with the glass, it is also foreseeable that a young child will be drawn to the fireplace and contact the glass through exploration. Young children are drawn to vivid and dynamic objects. Fire – the movement of the flames, the changes in color – is intriguing. As noted by Naqui, Enoch and Shah (2005), "... The flames of fires provide an attractive glow to toddlers who can inadvertently touch the glass plates." Out of curiosity, a young child may approach the glass and lean against it in an effort to look more closely at the fire. Or, he may put a hand out towards the fire in an effort to touch it, again resulting in contact with the glass.

Curiosity about fire is believed to be universal among children and a normal part of development (Gaynor and Hatcher, 1987). That children are attracted to fire was an important factor in the CPSC's decision to require child-resistant features on novelty and utility lighters (Meiers, 1996).

Consumers Lack Awareness of the Hazard

Some manufacturers include a warning about the high glass temperature on the fireplace. However, as in the case presented here, the warning is typically positioned under the base of the fireplace, behind a removable panel where the pilot light is located. Since the gas fireplace works with the flip of the switch, most consumers have no reason to lift this panel in the course of normal use. Placement of a warning in a location where it is not likely to be seen by the fireplace user demonstrates the inappropriateness of warnings as a means of addressing this hazard.

Warnings in the product's "Installation Manual" are also not likely to be seen as the average consumer does not install the gas fireplace. After it is installed, it should operate easily by turning on the wall switch, as noted. If there is a problem with the fireplace or if repairs are required, it is likely that the consumer will call a specialized technician, especially if they are renters like Marin Montgomery's mother.

Because consumers are not likely to read the any or all of the Installation Manual, they will not see the information about the option to purchase an additional safety screen. Furthermore, it is my understanding that it is too late to request an integral screen at that point since it must be installed at the factory.

Without the benefit of seeing a warning, the average consumer has no basis for knowing that the exterior glass of a fireplace can get hot enough to cause instantaneous burns. Nor does the consumer have any way of knowing how long the dangerously high temperatures persist after the product is turned off. Additionally, the average consumer does not know of pediatric injury data associated with gas fireplaces.

While one can easily recognize the hazard of an exposed flame or an open fireplace and may even suspect that the glass front will be warm or even somewhat hot, it is not "common knowledge" that the glass front of a gas fireplace can reach 500 degrees F. Not only does the average consumer not know that the glass fronts reach temperatures of this extreme, it is also not likely that s/he can even appreciate how quickly and how severely injuries will be if the glass is contacted. Five hundred degrees Fahrenheit exceeds what most consumers can appreciate as being "hot." The average consumer has no idea what will happen to skin when it contacts 500 degree F glass for even a moment.

This lack of knowledge by consumers was expressed in comments of parents whose children have been burned (Pollack-Nelson, 2009). One father noted that prior to his son's incident; he had no idea if the glass front on the gas fireplace got hot. "It had never crossed my mind." Another consumer who wrote to a gas fireplace manufacturer, stating that he had no idea how dangerous a fireplace becomes when it is on. Further, he consulted with other parents who agreed that they "...assumed the glass was of such material that it would not get hot!"

Not only are consumers not likely to realize that the glass front becomes treacherously hot, but it is quite likely that some will view the glass front as a protective barrier from the flames. In other words, the glass front may provide a false sense of security. According to one parent, "I thought the glass protected the heat from the outside... I thought the glass was heat-resistant."

The absence of any guard or barrier over the front of the glass contributes to the perception that the glass is touchable. A guard can serve not only as a barrier to a hazard, but also as an indication that the hazard exists. Consumers expect that products in their home are safe and dangers are guarded against. As one angry parent wrote in a letter to a manufacturer: "One would not assume since there is no protective screen/stop around these fireplaces that the glass would get so hot..."

Consumers perceptions of the glass as a safe-to-touch barrier are forged not only from a lack of obvious hazard (i.e., lack of a conspicuous warning and barrier, no color change), but also from experience with other household appliances, such as their oven. Oven doors serve as a barrier from the high heat inside. Some parents have stated that they believed the gas fireplace would be like other appliances in the home and that you would not get burned if you touch it.

In sum, the average consumer has no reason to suspect that the glass front of a gas fireplace presents an acute and severe burn hazard. While it is common knowledge that the interior of the fireplace gets hot, it is beyond the average consumers' ability to discern the temperature of the front of the glass.

Supervision

When children become injured on adult or household products, their parents are often accused of failing to supervise appropriately. However, in many cases – including those involving pediatric burns on the hot glass of a gas fireplace - the parent was in the same room as the child and supervising him or her directly (e.g., talking with the child) but still unable to prevent the injury from occurring.

The CPSC specifically addressed the issue of supervision and injuries to children in a Federal Register notice for "Requirements for the Special Packaging of Household Substances; Final Rule (Code of Federal Regulations, 1995). In this notice, the Commission called for special packaging for certain poisonous household objects to protect children:

> The Committee... believes that parental negligence is not the primary cause of poisonings. There are too many potentially hazardous products in the modern home to hope that all of them can be kept out of the reach of children. Special packaging will accomplish what previous efforts have not b[y] attempting to create positive separation between young children and hazardous substances. Special packaging is intended simply to make the environment of young children safer (p. 37723).

Passive Intervention Needed To Protect Children

Siekmann (1989, 1990) found that a large number of burn accidents result from a person being unaware of any danger from a hot surface or accidental contact. He suggested protective measures be added to products if the danger from a hot surface is not visible or obvious (1990).

Presently, some manufacturers provide a protective mesh screen with their gas fireplaces. Yet, many do not and the industry standard does not require this. Some manufacturers offer protective screens as an accessory, however, as noted, consumers may not see this information in the manual until after the fireplace is installed (since they are given the manual at the time of installation). Furthermore, since a screen is not required, consumers may not recognize it as a safety necessity. Also, consumers who purchase an existing home or rent their residence are not likely to know about the screen option since the fireplace is already installed in the home.

Passive interventions, like an integral safety screen, that do not require action by the parent to ensure a child's safety has been advocated in the published literature for decades (Dershewitz and Williamson, 1977; Eichelberger, Gotschall, Feely, Harstad and Bowman, 1990; Morrongiello and Dayler, 1996; Ytterstad, Smith and Coggan, 1998). In fact, this is the basis for child-resistance features found on numerous adult, household products including heater grill guards, child-resistant cigarette and utility lighters, and child-resistant caps on medicines and cleaning supplies.

Incorporating protective devices into household products that are not specifically intended for young children was addressed in a Public Hearing on Disposable Butane Lighters:

> Congress took explicit action to anticipate types of problems that we run into with children getting access to these types of products, and therefore, safety problems developing. Congress did the same with respect to refrigerators. That would be another area where the refrigerator is not intended for children, but in order to prevent entrapment, Congress literally passed a standard... Similarly with respect to lead in paint, not a product intended for children... Or more recently... lead and wrapping paper... drinking glasses. But all areas where the product itself is not intended, really, for children but where hazard would manifest itself over time, with respect to children gaining access to that product.

Studies of the pediatric burn risk associated with gas fireplaces consistently recommend a barrier be employed to prevent injuries. Becker & Cortotto (1998), who studied gas fireplaces in connection with a pediatric burn case, recommended that mechanical guards be provided with all gas fireplace units. "Small children are at risk of contact burns from these units, even with short duration contacts. We propose that gas fireplace manufacturers give consideration to the installation of protective barriers..." (p. 89).

Zettel, Khambalia, Barden, Murthy, and Macarthur (2004) came to the same conclusion after studying the burns of 27 young children. "Given the etiology of these burns (loss of balance or curiosity), passive prevention, such as barriers or changes in the composition of glass panels, may be the most effective approach to combat them" (p. 512).

The British Standard EN 563:1994 (referenced earlier) recommends protective measures to prevent burns on touchable hot surfaces: "Engineering measures are preferred and should be given priority" (p. 16). These include: Reduction of surface temperature; insulation; and guards (screen or barrier). The standard identifies the following factors that make protective measures against burning all the more important:

- the higher the measured surface temperature is above the burn threshold;
- the longer the surface temperature exceeds the burn threshold;
- the less the risk of burning is known to the person liable to be burned (e.g., children);
- the smaller the chance is for counter-reaction;
- the more accessible the hot surface is;
- the higher the contact risk is in accordance with the intended use;
- the more frequently the contact is likely to occur;
- the smaller the previous knowledge of the user concerning safe handling of the machine with a hot surface is to be expected (p.14).

Petition Request

In May 2010, I submitted the extensive information found in this petition to the ANSI/CSA Subcommittee for Gas Vented Fireplaces, requesting that revisions be made to the standard in order to mitigate the burn risk. In the ensuing year, industry met to discuss the petition, but the standard was not revised. Furthermore, last week, I was informed by a representative of the Subcommittee that at this time, there is no plan to make any revisions.

Due to industry's failure to act, I am petitioning the CPSC to develop a mandatory standard that will adequately protect consumers, and particularly children, from this hazard. Specifically, I am asking the Commission to develop a mandatory standard for gas fireplaces that requires an integral protective barrier, guard or other device for any accessible surface (e.g., glass fronts) that, if contacted, is hot enough to cause severe burns.

I appreciate the Commission's consideration of this request. I am available to discuss this petition at your convenience.

Respectfully submitted,

Carol Pollack-Nelson, Ph.D.

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May 20, 2011

Carol Pollack-Nelson, Ph.D.
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Dear Dr. Pollack-Nelson:

This responds to your submission dated April 12, 2011, asking that the Consumer Product Safety Commission ("the Commission") initiate rulemaking to require safeguards on glass fronts of vented gas fireplaces. For the reasons stated below, we do not believe that your request meets the Commission's requirements for petitions as set forth in 16 C.F.R. Part 1051.

The Commission has certain requirements for petitions that are set out in our regulations. Compliance with these requirements allows the Commission to undertake a review of the petition to determine whether it merits further action.

Your request meets almost all of the petition requirements. It is in English, provides your name and address, indicates the product at issue, and sets forth facts which establish the claim that the issuance of the rule is necessary. 16 C.F.R. § 1051.5(a)(1)-(4). The Commission's petition regulations also require that a petition contain "a brief description of the proposed rule" that the Commission should issue. Id. § 1051.5(a)(5). Your letter does cite various voluntary standards which address the hazards of hot, touchable surfaces. It also discusses the ineffectiveness of warnings contained only in operation and instruction manuals or out of sight of the consumer. Your letter also points out consumers may not be aware of the option to purchase safety screens for gas fireplaces, and that it may not be possible to install an integral safety screen on a vented gas fireplace after the gas fireplace's installation. What we would need from you before docketing this as a petition is a brief summary of what a proposed rule might include to address these various issues you have identified, as required by 16 C.F.R. 1051.5(a)(1)(5)). Your resubmission should be directed to the Commission's Office of Secretary.

Sincerely,

Cheryl A. Falvey

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Last year, I was retained as an expert witness in a lawsuit filed on behalf of 11-month-old Marin Montgomery who suffered painful and disfiguring third burns after contacting the glass front of a gas fireplace. Marin lived with her mother and siblings in a rental apartment that had a gas fireplace in the living room. The fireplace glass was flush with the wall and positioned near the ground. Marin had been sitting on the living room floor with her mother who had just finished wrapping holiday gifts. Marin

got up and toddled in the direction of the gas fireplace, which had been on for a period of time. Unbeknownst to her mother, the fireplace glass had reached a temperature of around 400° F.

Marin, who had just started walking, tripped & fell forward. Although her mom reached to grab her, the little girl had already stumbled and fallen against the vertical surface in front of her – the glass of the gas fireplace. Her mother immediately removed Marin from the glass, but it was too late. Her daughter's injuries were immediate. She suffered 3rd degree burns to both palms and scarring burns to her nose & forehead.

As it turns out, Marin's experience is not uncommon. The Consumer Product Safety Commission's (CPSC, 2009) National Electronic Injury Surveillance System (NEISS) database estimates that from 1999 through March 2009, over 2000 children aged 0-5 years suffered burn injuries on gas fireplaces. All incidents reported that the child fell into, backed into, or otherwise contacted the fireplace. Most specifically mentioned contact with the glass. Hands were the part of the body most frequently injured. However, there were a number of reports of arm, finger, lower trunk and facial injuries as well.

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This warning tag is attached to the pilot light which is located beneath the fireplace, and behind an access door.

Burn Potential & Hot Surfaces

Information about the burn potential of hot surfaces was published in the 1940s by Henriques and Mortiz of the Harvard Medical School. Their research showed a temperature-time relationship for burns (Mortiz and Henriques, 1947; Henriques, 1948). Through their research, they determined the following:

The level of skin damage to the duration and intensity of surface contact can be related by the following curve (Fig. 1). Exposures below the lower curve should not produce permanent injury in normal humans. Exposures between the curves are described as second-degree burns and have intermediate levels of cell damage. Exposures at levels above the top line are defined as third-degree burns that cause deep, permanent cell damage and scarring (ASTM C1055-03, p. 7).

The graph depicted in Figure 1, below, shows the Temperature-Time Relationship for Burns. According to this graph, complete transepidermal necrosis (cell death) occurs after 1 second at temperatures above 158 ° F (70°C).

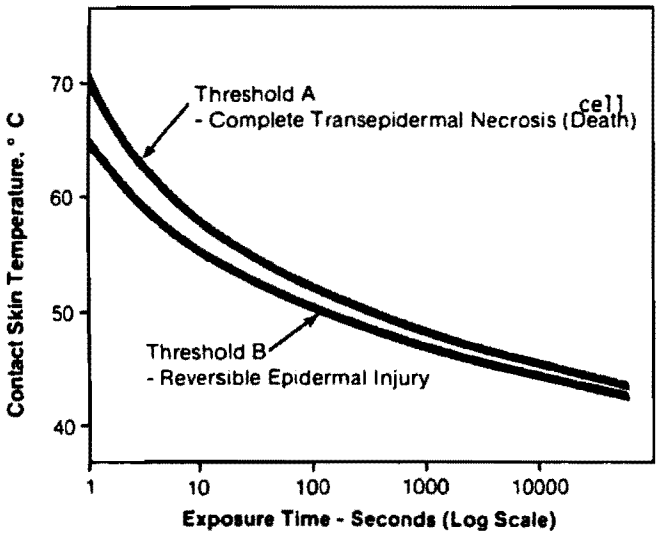

FIG. 1 Temperature-Time Relationship for Burns
ASTM C1055-03, Standard Guide for Heated System Surface Conditions that Product Contact Burn Injuries, ASTM International

Voluntary Standards and Surface Temperature Limits

A number of voluntary standards have incorporated the findings of Henriques & Moritz. *ASTM Standard Guide for Heated System Surface Conditions that Product Contact Burn Injuries* (C 1055-003) states that the maximum level of injury recommended is that causing first degree burns in the *average* subject. "At no time, however, are conditions that produce third degree burns recommended." The standard recommends surface temperatures below 158 degrees F.

The standard also cites the work of Stoll, Chianta and Piergallini (1979) who examined the relationship between pain, reaction times, and injury and established a minimum time to sense pain and

react to it at any temperature to be a minimum of 0.3 s. Wu (1977) "...recommended that a 1-minute exposure limit be used for design purposes for persons who have slow reactions (infants, elderly, or infirmed) or who *freeze* under severe hazard conditions."

According to the Underwriters Laboratories *Standard for Household Electric Ranges* (2005), the maximum acceptable temperature of glass surfaces as measured by a probe is 172°F. Temperature limits are increased 31°F for areas that will be more than 3 feet above the floor level, as installed.

Two British Standards address hazards of hot, touchable surfaces. The British Standard EN 563 (1994), *Safety of machinery – Temperatures of Touchable Surfaces – Ergonomics Data to Establish Temperature Limit Values for Hot Surfaces* states that the burn threshold for contacting glass for a time of 0.5 seconds is between 183.2° and 194° F.

British Standard EN 13202 (2000), *Ergonomics of the Thermal Environment. Temperatures of touchable hot surfaces - Guidance for Establishing Surface Temperature Limit Values in Product Standards with the Aid of EN 563,* instructs a protocol for determining hazardous touchable surfaces and the risk they pose (pp.6-7). First, identify all accessible, touchable hot surfaces. Next, perform a task analysis that identifies the activities involved in using the product. "Particular attention shall be paid to possible intentional and unintentional contact with hot surfaces and to which persons (users of the product and others) it may occur" (p. 6). Next, hot surfaces are measured during normal operating conditions of the product. "If the surface temperature is above the burn threshold, cutaneous injury upon contact with the hot surface is to be expected" (p. 6).

The standard specifically mentions "unintentional contact" by children (p. 8), instructing that extended reaction time is expected with children, so at least 4 seconds is used to calculate the minimum contact period. For younger children, this time will be longer: "Until 24 months children do not have reflexes which are quick enough to remove their hands from what burns them. They do not always have the ability to get away from hot surfaces therefore. The contact period can be up to 15 s for very young children."

Studies of Pediatric Burns on Glass Fronts of Gas Fireplaces

Medical professionals who have treated children with severe contact burns resulting from contact with gas fireplaces provide insight into the hazard pattern. Becker and Cartotto (1998) reported on an 11-month-old boy who sustained burns to his hand after touching the glass front of a gas fireplace. The child's parents had turned off the fireplace approximately five minutes prior to the accident.

The authors conducted experiments whereby they measured the glass temperature of three gas fireplace models. The maximum measurable temperature for one glass front was 254° C (489° F); the temperature was still increasing, however, the adhesive metal tape melted, preventing further measurements. Within an average of 6.5 minutes, the other fireplaces reached 392° F. Further, an average of 12.3 minutes was required for the appliances to cool from 392° F to 212° F. One unit was cooled to 122° F, which required 27.5 minutes (p. 87).

Based on their findings, the authors reported, that a "...a partial-thickness burn could occur with less than one second of contact with the glass front of a gas fireplace that had reached a maximum steady state temperature. Additionally, less than one second would be required for a partial thickness burn five minutes after the fireplace had been extinguished."

Dunst, Scott, Kraatz, Anderson, Twomey, and Peltier (2004) reported seeing "an alarming increase in the incidence of pediatric palm burns associated with gas fireplaces." A retrospective chart review was conducted to identify patients under five years who sustained hand burns after contacting the glass of a gas fireplace. From January 1996 through December 2002, 39 patients ranging in age from seven to 23 months were identified (mean age was approximately 13 months). This represented a 15-fold increase in pediatric burns associated with gas fireplace glass contact since 1996. Furthermore, "...this increase is strongly correlated with an increase in the sales of glass-enclosed gas fireplaces during the same period" (p. 69).

Zettel, Khambalia, Barden, Murthy, and Macarthur (2004) identified 27 children who presented to The Hospital for Sick Children in Toronto between 1999 and 2002 due to gas fireplace contact burns. The children ranged in age from eight to 36 months (median age was 14 months). More than one-third of victims (37%) were injured after their lost their balance near the fireplace; another 30 percent were injured when they touched the glass front out of curiosity. Remaining injuries resulted from the child walking too close to the glass front.

Naqui, Enoch and Shah's (2005) retrospective data analysis identified 35 pediatric cases of contact burns from glass plates of gas fireplaces at a hospital in Manchester, England between 1994 and 2001. Most injuries involved the hand, palm or fingers. Other injuries affected the forearm, face, buttocks or thighs. All cases were accidental.

> Naqui, et. al. cited the study by Moritz and Henriques which indicated that: "... a temperature of 70° C [158° F] would cause a partial thickness burn in less than one second. Normal reaction time to a painful stimulus is .25s in a healthy adult...but this is obviously delayed in those with restricted mobility like toddlers. With glass plates of gas fires reaching temperatures of 245° C [473° F] within 15 min...., toddlers would have an extremely high risk of sustaining burn injury from such devices (2005, p. 74).

Human Factors Issues relating to Burns on the Glass from Gas Fireplaces

The hazard posed by gas fireplaces is due to a combination of factors including the high surface temperature of the fireplace glass, the accessible location of the glass front, the attractiveness of fire to young children, and the lack of consumer awareness of the hazard.

Fireplaces are situated in a family room or other communal areas of the home, approximately 6 inches from the floor. As was the case in Marin's home, they can cover an area of about 35 x 35 inches.

The low height of the fireplace glass makes it accessible to young children. Toddlers, who are unsteady on their feet, are particularly vulnerable to inadvertently falling into or contacting the glass. This bears out in pediatric data that shows that the average age of victims was about 13-14 months Dunst, et. al. (2004) and Zettel, et. al. (2004). Most children walk independently between 10 and 15 months of age and are considered to be "toddlers" for about a year as they learn to become steady on their feet. Children this age frequently lose their footing when walking or standing. A toddler who is walking near the wall where the fireplace is positioned, may, foreseeably, fall against it.

The fireplace, when built into the wall and flush with it serves as a physical substitute for the section of wall that it replaces. Toddlers range in height from about 28-29 inches. If a child were toddling near the subject fireplace, his or her hands and other parts of the body would surely contact the glass, as occurred in more than 2,000 incidents in the last 10 years.

Aside from unintentional contact with the glass, it is also foreseeable that a young child will be drawn to the fireplace and contact the glass through exploration. Young children are drawn to vivid and dynamic objects. Fire – the movement of the flames, the changes in color – is intriguing. As noted by Naqui, Enoch and Shah (2005), "... The flames of fires provide an attractive glow to toddlers who can inadvertently touch the glass plates." Out of curiosity, a young child may approach the glass and lean against it in an effort to look more closely at the fire. Or, he may put a hand out towards the fire in an effort to touch it, again resulting in contact with the glass.

Curiosity about fire is believed to be universal among children and a normal part of development (Gaynor and Hatcher, 1987). That children are attracted to fire was an important factor in the CPSC's decision to require child-resistant features on novelty and utility lighters (Meiers, 1996).

Consumers Lack Awareness of the Hazard

Some manufacturers include a warning about the high glass temperature on the fireplace. However, as in the case presented here, the warning is typically positioned under the base of the fireplace, behind a removable panel where the pilot light is located. Since the gas fireplace works with the flip of the switch, most consumers have no reason to lift this panel in the course of normal use. Placement of a warning in a location where it is not likely to be seen by the fireplace user demonstrates the inappropriateness of warnings as a means of addressing this hazard.

Warnings in the product's "Installation Manual" are also not likely to be seen as the average consumer does not install the gas fireplace. After it is installed, it should operate easily by turning on the wall switch, as noted. If there is a problem with the fireplace or if repairs are required, it is likely that the consumer will call a specialized technician, especially if they are renters like Marin Montgomery's mother.

Because consumers are not likely to read the any or all of the Installation Manual, they will not see the information about the option to purchase an additional safety screen. Furthermore, it is my understanding that it is too late to request an integral screen at that point since it must be installed at the

factory.

Without the benefit of seeing a warning, the average consumer has no basis for knowing that the exterior glass of a fireplace can get hot enough to cause instantaneous burns. Nor does the consumer have any way of knowing how long the dangerously high temperatures persist after the product is turned off. Additionally, the average consumer does not know of pediatric injury data associated with gas fireplaces.

While one can easily recognize the hazard of an exposed flame or an open fireplace and may even suspect that the glass front will be warm or even somewhat hot, it is not "common knowledge" that the glass front of a gas fireplace can reach 500 degrees F. Not only does the average consumer not know that the glass fronts reach temperatures of this extreme, it is also not likely that s/he can even appreciate how quickly and how severely injuries will be if the glass is contacted. Five hundred degrees Fahrenheit exceeds what most consumers can appreciate as being "hot." The average consumer has no idea what will happen to skin when it contacts 500 degree F glass for even a moment.

This lack of knowledge by consumers was expressed in comments of parents whose children have been burned (Pollack-Nelson, 2009). One father noted that prior to his son's incident; he had no idea if the glass front on the gas fireplace got hot. "It had never crossed my mind." Another consumer who wrote to a gas fireplace manufacturer, stating that he had no idea how dangerous a fireplace becomes when it is on. Further, he consulted with other parents who agreed that they "...assumed the glass was of such material that it would not get hot!"

Not only are consumers not likely to realize that the glass front becomes treacherously hot, but it is quite likely that some will view the glass front as a protective barrier from the flames. In other words, the glass front may provide a false sense of security. According to one parent, "I thought the glass protected the heat from the outside... I thought the glass was heat-resistant."

The absence of any guard or barrier over the front of the glass contributes to the perception that the glass is touchable. A guard can serve not only as a barrier to a hazard, but also as an indication that the hazard exists. Consumers expect that products in their home are safe and dangers are guarded against. As one angry parent wrote in a letter to a manufacturer: "One would not assume since there is no protective screen/stop around these fireplaces that the glass would get so hot..."

Consumers perceptions of the glass as a safe-to-touch barrier are forged not only from a lack of obvious hazard (i.e., lack of a conspicuous warning and barrier, no color change), but also from experience with other household appliances, such as their oven. Oven doors serve as a barrier from the high heat inside. Some parents have stated that they believed the gas fireplace would be like other appliances in the home and that you would not get burned if you touch it.

In sum, the average consumer has no reason to suspect that the glass front of a gas fireplace presents an acute and severe burn hazard. While it is common knowledge that the interior of the fireplace gets hot, it is beyond the average consumers' ability to discern the temperature of the front of the glass.

Supervision

When children become injured on adult or household products, their parents are often accused of failing to supervise appropriately. However, in many cases – including those involving pediatric burns on the hot glass of a gas fireplace - the parent was in the same room as the child and supervising him or her directly (e.g., talking with the child) but still unable to prevent the injury from occurring.

The CPSC specifically addressed the issue of supervision and injuries to children in a Federal Register notice for "Requirements for the Special Packaging of Household Substances; Final Rule (Code of Federal Regulations, 1995). In this notice, the Commission called for special packaging for certain poisonous household objects to protect children:

> The Committee... believes that parental negligence is not the primary cause of poisonings. There are too many potentially hazardous products in the modern home to hope that all of them can be kept out of the reach of children. Special packaging will accomplish what previous efforts have not b[y] attempting to create positive separation between young children and hazardous substances. Special packaging is intended simply to make the environment of young children safer (p. 37723).

Passive Intervention Needed To Protect Children

Siekmann (1989, 1990) found that a large number of burn accidents result from a person being unaware of any danger from a hot surface or accidental contact. He suggested protective measures be added to products if the danger from a hot surface is not visible or obvious (1990).

Presently, some manufacturers provide a protective mesh screen with their gas fireplaces. Yet, many do not and the industry standard does not require this. Some manufacturers offer protective screens as an accessory, however, as noted, consumers may not see this information in the manual until after the fireplace is installed (since they are given the manual at the time of installation). Furthermore, since a screen is not required, consumers may not recognize it as a safety necessity. Also, consumers who purchase an existing home or rent their residence are not likely to know about the screen option since the fireplace is already installed in the home.

Passive interventions, like an integral safety screen, that do not require action by the parent to ensure a child's safety has been advocated in the published literature for decades (Dershewitz and Williamson, 1977; Eichelberger, Gotschall, Feely, Harstad and Bowman, 1990; Morrongiello and Dayler, 1996; Ytterstad, Smith and Coggan, 1998). In fact, this is the basis for child-resistance features found on numerous adult, household products including heater grill guards, child-resistant cigarette and utility lighters, and child-resistant caps on medicines and cleaning supplies.

Incorporating protective devices into household products that are not specifically intended for young children was addressed in a Public Hearing on Disposable Butane Lighters:

> Congress took explicit action to anticipate types of problems that we run into with children getting access to these types of products, and therefore, safety problems developing. Congress did the same with respect to refrigerators. That would be another area where the refrigerator is not intended for children, but in order to prevent entrapment, Congress literally passed a standard... Similarly with respect to lead in paint, not a product intended for children... Or more recently... lead and wrapping paper... drinking glasses. But all areas where the product itself is not intended, really, for children but where hazard would manifest itself over time, with respect to children gaining access to that product.

Studies of the pediatric burn risk associated with gas fireplaces consistently recommend a barrier be employed to prevent injuries. Becker & Cortotto (1998), who studied gas fireplaces in connection with a pediatric burn case, recommended that mechanical guards be provided with all gas fireplace units. "Small children are at risk of contact burns from these units, even with short duration contacts. We propose that gas fireplace manufacturers give consideration to the installation of protective barriers..." (p. 89).

Zettel, Khambalia, Barden, Murthy, and Macarthur (2004) came to the same conclusion after studying the burns of 27 young children. "Given the etiology of these burns (loss of balance or curiosity), passive prevention, such as barriers or changes in the composition of glass panels, may be the most effective approach to combat them" (p. 512).

The British Standard EN 563:1994 (referenced earlier) recommends protective measures to prevent burns on touchable hot surfaces: "Engineering measures are preferred and should be given priority" (p. 16). These include: Reduction of surface temperature; insulation; and guards (screen or barrier). The standard identifies the following factors that make protective measures against burning all the more important:

- the higher the measured surface temperature is above the burn threshold;
- the longer the surface temperature exceeds the burn threshold;
- the less the risk of burning is known to the person liable to be burned (e.g., children);
- the smaller the chance is for counter-reaction;
- the more accessible the hot surface is;
- the higher the contact risk is in accordance with the intended use;
- the more frequently the contact is likely to occur;
- the smaller the previous knowledge of the user concerning safe handling of the machine with a hot surface is to be expected (p.14).

Petition Request

In May 2010, I submitted the extensive information found in this petition to the ANSI/CSA Subcommittee for Gas Vented Fireplaces, requesting that revisions be made to the standard in order to mitigate the burn risk. In the ensuing year, industry met to discuss the petition, but the standard was not revised. Furthermore, last week, I was informed by a representative of the Subcommittee that at this time, there is no plan to make any revisions.

Due to industry's failure to act, I am petitioning the CPSC to develop a mandatory standard that will adequately protect consumers, and particularly children, from this hazard.

I appreciate the Commission's consideration of this request. I am available to discuss this petition at your convenience.

Respectfully submitted,

Carol Pollack-Nelson, Ph.D.

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