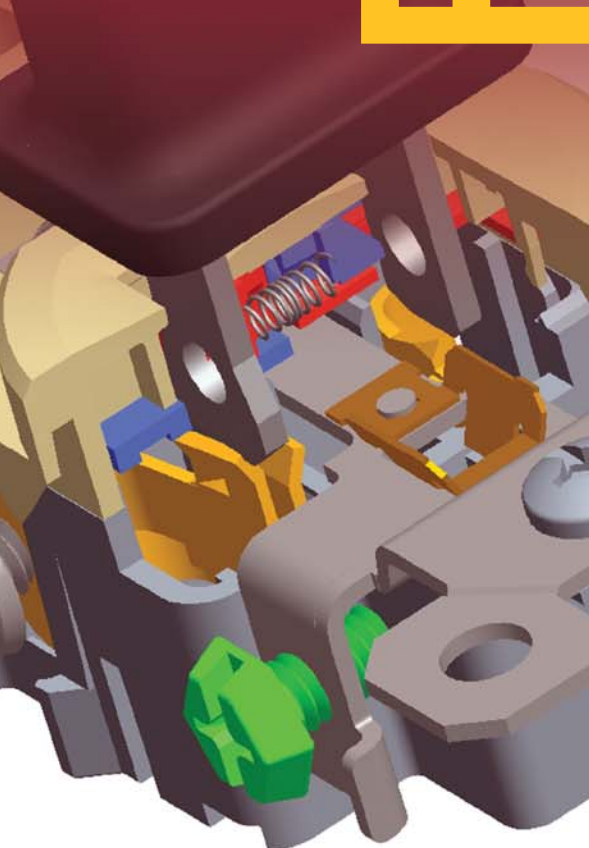


# SPECIAL FEATURES

SECTION



## Children and Electrical Outlets: An Opportunity to Enhance Safety

by Andrei Moldoveanu

**Electricity** has provided comfort and convenience to households for more than a century, and manufacturers have made great strides to ensure its safe use over the years. From fuses and circuit breakers that prevent equipment damage from excessive current to the literally ground-breaking protection of the ground fault circuit interrupter (GFCI), manufacturers have developed countless devices for consumers to reap all of electricity's benefits while minimizing the risk of electric shock.

Despite the wealth of technological advancements, electrical manufacturers can't offer fool-proof solutions to human error. And since human nature challenges us to explore, experiment and learn from our mistakes, injury or death can sometimes be the result.

For decades, parents have been concerned about the danger electricity poses to children, and several products, such as plastic outlet caps and child-resistant wall plates, claim to prevent this hazard. And, though not widely used in homes, tamper-resistant receptacles have long been considered the most reliable means of child protection. But the sad reality, according to data from the U.S. Consumer Product Safety Commission (CPSC), is that about 2,400 children 10 years old or younger suffer electrical injuries each year. And, although rare, some cases end tragically.

In an effort to reduce these alarming statistics, a revision has been added to the 2008 *National Electrical Code*® (NEC), effective January 1. The revision requires all electrical outlets, or receptacles, in newly constructed homes to be tamper-resistant. However, some electrical and building industry professionals have objected to the Code revision, concerned about the increased cost of tamper-resistant devices.

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As the leading trade association representing approximately 450 electrical manufacturers, the National Electrical Manufacturers Association (NEMA) provides leadership in developing technical standards that serve the best interests of both the industry and consumers. In this article, NEMA provides an overview of the child safety statistics that inspired the Code revision, specific information on Code requirements, and clarification on Code misconceptions—to educate industry professionals and legislators about the importance of Code adoption.

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## The Unfortunate Facts

NEMA conducted a study based on data from the U.S. Consumer Product Safety Commission (CPSC) and National Electronic Injury Surveillance Systems (NEISS). Findings indicated that, from 1991 to 2001, more than 24,000 children 10 years old or younger were treated in emergency rooms for incidents related to electrical receptacles. On average, this translates to *about seven children every day*.

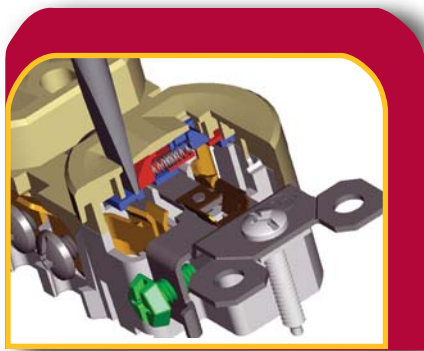
It's estimated that 89 percent of the children injured were less than six years old, but toddlers carried the greatest risk. With more than 12,000 victims between ages two and three, toddlers accounted for half of the children represented in the 10-year study. Data also showed boys to be at the highest risk, regardless of age.

The Canadian Hospitals Injury Reporting and Prevention Program (CHIRPP) performed a similar study in 14 CHIRPP hospitals from 1996 to 2003. During this period, 465 children less than nine years old received emergency room treatment for incidents related to electrical receptacles. Forty percent of these children were between three and six years old, and nearly 85 percent were under age four.

## How Accidents Happen

Electrical injuries occur because of several factors:

- Pre-exposure conditions unintentionally exist
- A metallic object inserted into an outlet becomes electrified
- A child touching the object could receive a powerful electric shock
- Children have less resistance to electric shock than adults



The inserted object also contacts a grounding point and creates a short-circuit, which results in arcing and heat that can cause burns.

## Typical Location of Incidents

From CPSC Data

LOCATION	%	10-year Estimate
Home	71%	17,101
Schools/Public Areas	4%	950
Unknown	25%	6,086
<b>TOTAL</b>	<b>100%</b>	<b>24,137</b>

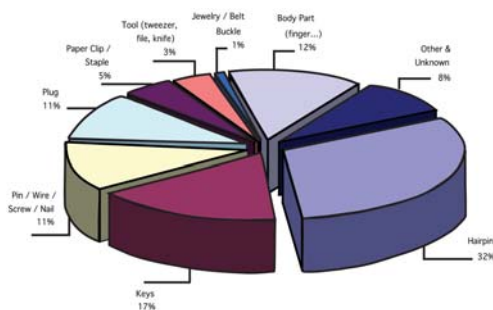
The table above shows that the majority of incidents occur at home, where adult supervision is typically present. Similarly, the CHIRPP study estimated that 79 percent of injuries occurred at home.

Most objects are everyday household items that children can access easily. Alarmingly, nearly half of the items (hairpins and keys) are *objects parents don't often consider dangerous*. These data show that even "safe" items can pose hazards.

The chart below reflects the wide variety of metal objects that children have been documented inserting into receptacles. They include, but aren't limited to: paper clips, pens, safety pins, screws and nails, tools, wire, forks, tweezers, hair pins, keys, knives and coins.

## Types of Items Inserted

From CPSC Data



## Preventive Measures

Since accidents can happen in seconds, preventive measures must be taken to ensure safety. There are several types of electrical safety products on the market, but even protective devices have shortcomings.

One popular device, the plastic outlet cap, offers an inexpensive "child-proofing" method. New parents often use plastic caps, and they are usually effective in protecting children under two years of age. However, statistics indicate that outlet caps could be ineffective in deterring toddlers and pre-school-age children.

According to a 1997 Temple University Biokinetics Laboratory study of two plastic cap brands, 47 percent of four-year-olds tested could remove one brand of cap. More alarming, 100 percent of the 2- and 4-year-old children removed the second brand of cap—and, in many cases in less than 10 seconds.

It is important to remember that no device can protect if unused. Adults often forget to reinsert receptacle caps after using an electrical outlet, leaving the receptacle exposed. Children can also gain access to exposed receptacles by simply pulling out cords for lamps, alarm clocks and other everyday devices.

Child-resistant wall plates offer better levels of protection than outlet caps, but they also have dangerous flaws. Most add extra layers of material between the plug blades and the receptacle contacts. This reduces the surface area between plug blades and contacts, causing potential heat rise or arcing.

Although not widely used in homes, tamper-resistant receptacles offer the most reliable solution. These devices have been mandated for use in hospital pediatric wards for more than 20 years, and they are proven to effectively prevent electrical injuries.

Tamper-resistant receptacles are:

- UL listed – subjected to intense, documented testing procedures
- Permanent – once installed, they offer continuous protection, unlike plastic outlet caps that can be removed or forgotten
- Reliable – this hard-wired solution eliminates the worry about inserting, losing or breaking the device
- Automatic – protection remains, even with plug or cord removal

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## Background on NEC 406.11

With the breadth of research and statistics on child injuries, the electrical industry determined a need to revise the NEC, demanding greater safety measures in homes. The Code revision states the following for NEC Article 406. 11 *Tamper Resistant Receptacles in Dwelling Units*: "In all areas specified in 210. 52, all 125-volt 15- and 20-ampere receptacles shall be listed tamper-resistant receptacles."

In short, all newly constructed homes will require tamper-resistant receptacles per the 2008 NEC. And, while injury statistics drove the code change, some electrical and building professionals are still resisting adopting the change, citing associated costs and potential problems for consumers. This section addresses code facts, myths and common questions.

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### Associated costs

How many greenbacks would it take to give new homes the green light for safety? According to NEMA's Business Information Service (NEMA/BIS), the investment increase for tamper-resistant receptacles is minimal.

NEMA estimates an average retail price increase of \$0.50 per tamper-resistant receptacle. The average new home includes 75 receptacles; therefore, homeowners could expect to pay an estimated \$37.50 to make all outlets tamper-resistant. This translates to a cost increase of less than 0.5 percent on an average total electrical installation of \$6,820.

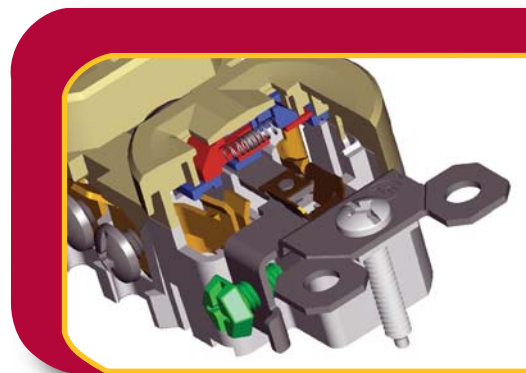
One might argue that homeowners should have the choice of whether to install tamper-resistant receptacles, perhaps because no small children would live in the house, but circumstances evolve. Neighbors and grand-

children visit, and homes change ownership. At less than \$50 to protect an entire house, installing tamper-resistant outlets presents an arguably small homeowner investment to ensure the greatest level of electrical safety for children.

### "Tamper Resistance" or "Tough Removal?"

Although European electrical receptacles commonly use tamper-resistant shutters for intrinsic safety, some electrical professionals in the United States have expressed concerns about increased insertion and removal forces required for tamper-resistant receptacles, citing potential challenges for an aging population. However, recent testing by several device manufacturers found no appreciable difference for insertion and removal forces between tamper-resistant and non-tamper-resistant receptacles.

Manufacturers measured 1) the amount of force necessary to insert a plug into the tamper-resistant shutters and 2) the amount needed for full insertion into a tamper-resistant receptacle. Results showed that plugs could pass through the shutters with minimal force, and that they could be fully inserted into electrical contacts with no additional force.



Testing showed no measurable change in the removal force between tamper-resistant and non-tamper-resistant receptacles. However, bent, damaged, or burred plug blades can make insertion harder with tamper-resistant receptacles. To ensure easier insertion and greater safety, users should examine and straighten or replace substandard plug blades.

### Support and Adopt NEC 2008

In addition to providing a forum to develop technical standards in the best interests of the industry and of electrical product users, NEMA advocates policies on legislative and regulatory matters affecting the industry and those it serves. NEMA manufacturers are designing and tooling all residential products necessary for the 2008 NEC implementation, with some devices already available for purchase.

NEMA encourages electrical inspectors, contractors and distributors to support this important safety enhancement. Contact electrical associations and local and state legislators to push for Code adoption.

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