

U.S. Consumer Product Safety Commission



Electrical Safety

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This presentation was prepared by CPSC staff, has not been reviewed or approved by, and may not reflect the views of, the Commission.

Electrical Product Hazard Prevention Strategies

CPSC staff promotes
electrical safety through
a multipronged
approach }

- Supporting improvements to voluntary standards/codes
- Creating and enforcing technical regulations and bans
- Identifying products with defects and hazards through surveillance activities and recalls
- Developing education programs for consumers

Voluntary Consensus Standards

- The electrical product safety system primarily relies on compliance with voluntary industry-consensus standards.
 - Most electrical product safety standards have been developed and maintained under the auspices of Underwriters Laboratories (UL). Other standards developers for electrical product safety include the Institute of Electrical and Electronics Engineers (IEEE) and the National Electrical Manufacturers Association (NEMA)
- There are only five technical regulations for electrical products under CPSC's jurisdiction.

Technical Regulations

CPSC's electrical products technical regulations:

- 16 CFR 1505 – Requirement for electrically-operated toys or other electrically-operated articles intended for use by children
- 16 CFR 1204 - Safety Standard for Omnidirectional Citizens Band Base Station Antennas
- 16 CFR 1120.3(a) – Requirement for handheld hair dryers to have an integral immersion protection circuit interrupter plug (as per UL 859 and UL 1727)



Technical Regulations


- 16 CFR 1120.3(c) – Requirement for seasonal and decorative lighting products to have a minimum wire size, sufficient strain relief, and overcurrent protection (as per UL 588)



- 16 CFR 1120.3(d) – Requirement for extension cords to have minimum wire size, sufficient strain relief, proper polarization, proper continuity, covers for outlets, and jacketed cords (as per UL 817)

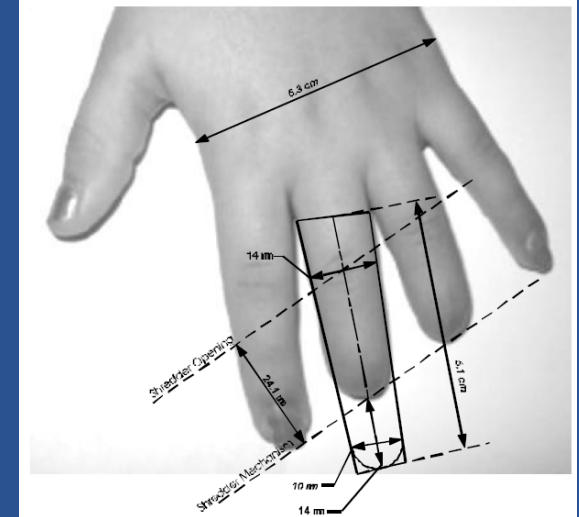


Voluntary Consensus Standards

- CPSC's regulations do not require third party certification for electrical products, but there is a high rate of voluntary participation
 - Many retailers will only sell electrical products if they have been third party certified
 - Some states and municipalities require certification for all electrical products to be sold in those jurisdictions
 - The Occupational Safety and Health Administration (OSHA) requires certification for electrical products used in the workplace
-  CPSC staff strongly recommends that manufacturers or exporters/importers seek third party certification for their electrical products as a means of hazard mitigation.

Voluntary Standards Process

VS Case Study #1: In 2004, document shredding machines were implicated in a number of hand injuries to small children.



Voluntary Standards Process

VS Case Study #1: Document Shredding Machines

Data Analysis

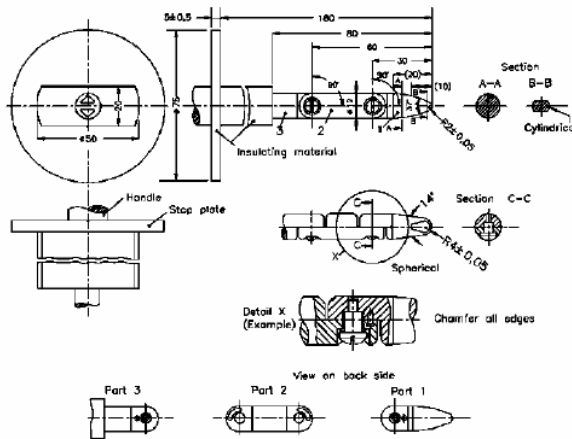
The most severe injuries, finger amputations, occurred when a child (even under adult supervision) was feeding paper into a shredder and did not release the paper in time and their hand was pulled into the opening.

Voluntary Standards Process

VS Case Study #1: Document Shredding Machines

Standards Review

CPSC staff reviewed UL 60950-1 *Information Technology Equipment – Safety – Part 1: General Requirements* for accessibility to moving parts requirements for paper shredders



SM471

Linear dimensions in mm

Excerpt from "Figure 2A – Test Finger"

UL 60950-1, *Safety of Information Equipment – Safety – Part 1: General Requirements*
First Edition, dated April 1, 2003, Page 63

Voluntary Standards Process

VS Case Study #1: Document Shredding Machines

Evaluation

CPSC staff acquired 10 different paper shredders for analysis and examined them for design variations and to assess the effectiveness of various accessibility probes in preventing contact with moving parts.

Table 10. Test Data Summary

Sample	Shredder Opening	CFR A	RP	CP 40	CP 50	CFR B	RP	CP 40	CP 50	RP	CP 40	CP 50	RP	60950	AP
A	5.5 mm (0.13 in)	No	No	No	No	No	NT	NT	NT	NT	NT	NT	NT	No	No
B	3.8 mm (0.16 in)	No	No	No	No	No	NT	No	NT	NT	NT	NT	NT	No	No
C	3.7 mm (0.14 in)	No	No	Yes	No	No	NT	No	NT	NT	NT	NT	NT	No	Yes
D	3.7 mm (0.14 in)	No	No	No	No	No	NT	No	NT	NT	NT	NT	NT	No	No
E	3.8 mm (0.15 in)	No	No	No	No	No	NT	NT	No	NT	NT	NT	NT	No	No
F	5.4 mm (0.21 in)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	Yes	No	Yes
G	4.3 mm (0.17 in)	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	No	No	No	No	Yes
H	4.9 mm (0.19 in)	No	Yes	Yes	Yes	No	No	No	No	NT	NT	NT	NT	No	No
I	4.4 mm (0.17 in)	No	No	Yes	Yes	No	NT	Yes	No	No	No	No	NT	No	No
J	2.9 mm (0.11 in)	Yes	Yes	Yes	Yes	No	Yes	No	Yes	NT	NT	NT	No	No	Yes

60950 The test finger referenced in UL 60950, Figure 2A used in Section 5.2.
CFR A The test finger referenced in 16 CFR §1000.48, Figure 2, Profile A, 0.36 months used in Section 5.2.
CFR B The test finger referenced in 16 CFR §1000.48, Figure 2, Profile B, 37-67 months used in Section 5.2.
CP 40 Compressible finger probe, 40A durometer used in Section 5.5.
CP 50 Compressible finger probe, 50A durometer used in Section 5.5.
RP Rigid probe used in Section 5.3.
AP Articulate Probe used in Section 5.5.
Yes The probe passed the shredder opening and contacted the shredder mechanism (with specified force).
No The probe did not pass the shredder opening (with specified force).
NT No test.

Voluntary Standards Process

VS Case Study #1: Document Shredding Machines

Standards Revision

U.S. CONSUMER PRODUCT SAFETY COMMISSION
DIRECTORATE FOR ENGINEERING SCIENCES



AN EVALUATION OF
FINGER INJURIES
ASSOCIATED WITH HOME
DOCUMENT (PAPER) SHREDDER MACHINES

DECEMBER 2004

CPSC-ES-0501

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CPSC staff issued a report of test results showing design/standard vulnerabilities and proposed formation of a working group to discuss approaches to fill the gaps in the requirements.

Voluntary Standards Process

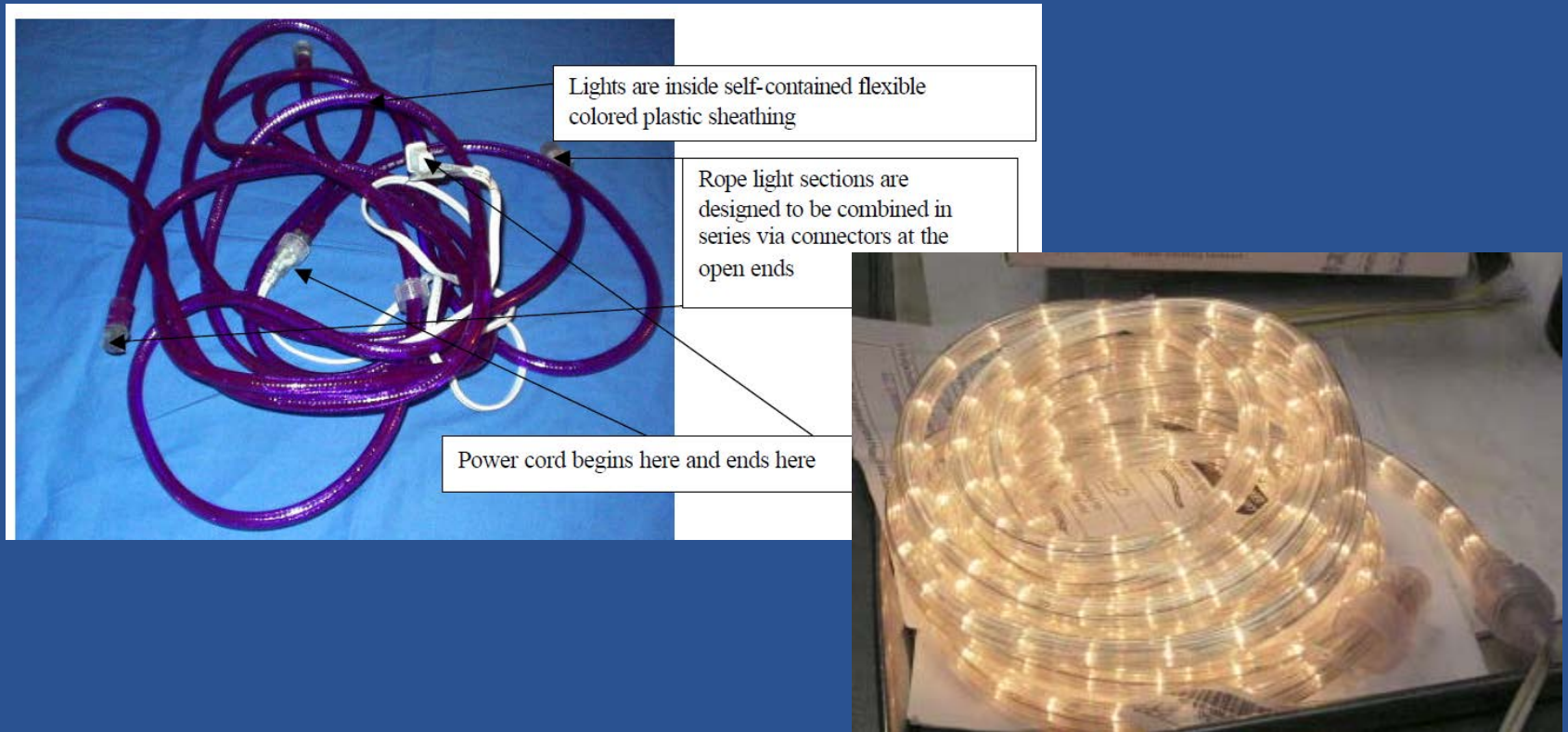
VS Case Study #1: Document Shredding Machines

Standards Panel Participation

CPSC staff participated in a UL 60950 working group to develop new test requirements to reduce access to hazardous moving parts.

Voluntary Standards Process

VS Case Study #2: Flexible Lighting Products (Rope Lights) were becoming popular, but no applicable standard existed .



A rope light is a string of series and/or series-parallel connected lamps enclosed in a flexible polymeric tube or extrusion.

Voluntary Standards Process

VS Case Study #2: Flexible Lighting Products (Rope Lights) Data Analysis

CPSC staff was receiving reports of incidents involving rope lights, which had been in use as a commercial product, but were being sold for residential use. Raised concerns about possible risks of shock or fire.



Voluntary Standards Process

VS Case Study #2 : Rope Lights

Standards Review

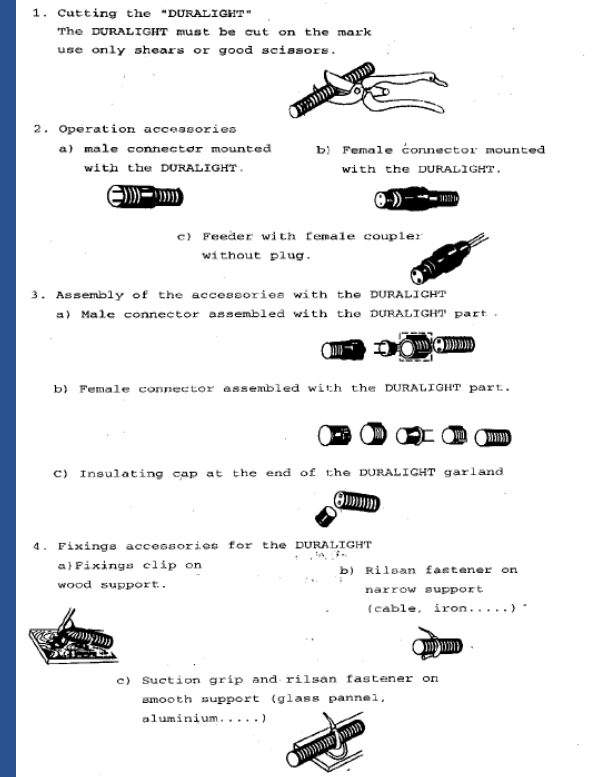
There was no standard for rope lights. Although similar to holiday lights in many respects, rope lights had several differences, including installation longer than 90 days, which put them out of the scope of UL 588.

Voluntary Standards Process

VS Case Study #2 : Rope Lights

Evaluation

CPSC staff examined rope lights and defined the areas of concern for residential use, such as field configuration (cutting lights to length).



Voluntary Standards Process

VS Case Study #2 : Rope Lights

Standards Revision

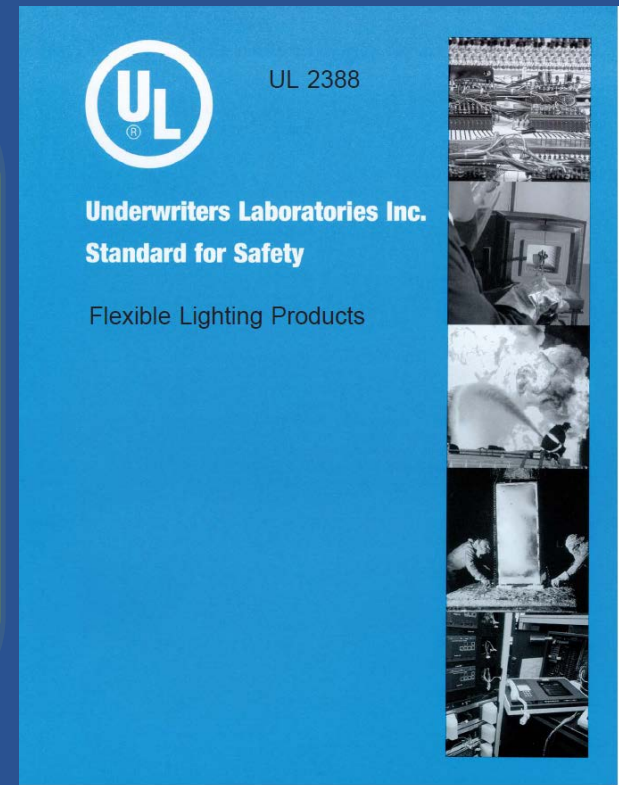
CPSC staff proposed development of standard to include requirements for rope lights based on identified potential hazards

Voluntary Standards Process

VS Case Study #2 : Rope Lights

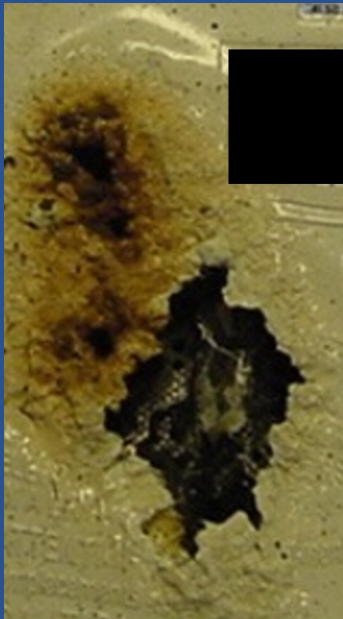
Standards Panel Participation

First Edition of UL 2388 –
*Standard for Safety of Flexible
Lighting Products* was issued July
3, 2002.



Voluntary Standards Process

VS Case Study #3: In 2002, fire incidents with power strips using surge protection were still occurring after changes were made to the voluntary standard in 1998, UL 1449 *Transient Voltage Surge Suppression*.



Voluntary Standards Process

VS Case Study #3: Surge Suppressors

Data Analysis

CPSC staff reviewed incident databases for surge suppressor incidents to determine the causes of fire incidents.

- Residential Fire Loss Estimates
- Reviewed 63 IDIs involving surge suppressors (97-01)
 - 8 deaths
 - 17 injuries
 - \$2.6M property loss

Voluntary Standards Process

VS Case Study #3: Surge Suppressors

Standards Review

CPSC staff reviewed UL 1449 *Transient Voltage Surge Suppressors* to determine weakness in the voluntary standard requirements.

Voluntary Standards Process

VS Case Study #3: Surge Suppressors

Standards Review

- UL 1449 - Transient Voltage Surge Suppressors
 - High voltage surge requirements
 - Must protect all three conductors (Feb 1998):
 - Line - Neutral
 - Line - Ground
 - Neutral - Ground
 - Performance requirements added
 - Resulted in addition of thermal protection (Feb 1998)

Voluntary Standards Process

VS Case Study #3: Surge Suppressors

Evaluation

CPSC staff acquired surge suppressors for evaluation and performed testing to validate weak spot in requirements.



Voluntary Standards Process

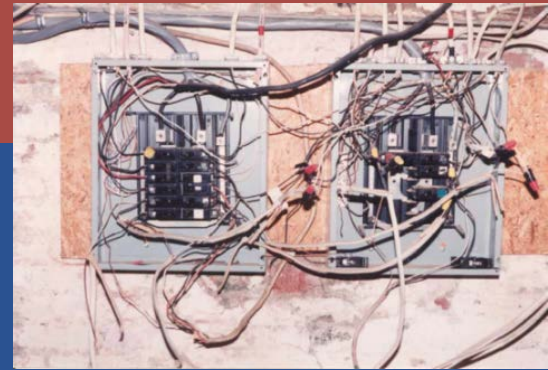
VS Case Study #3: Surge Suppressors

Standards Revision

CPSC staff found a weakness in voluntary standard and participated in the standards technical panel to add requirements in the voluntary standard.

Other Requirements

Safe Installation = Electrical Safety

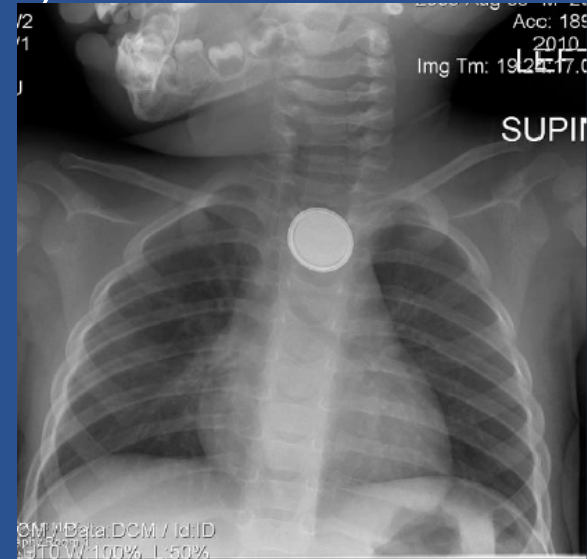


- The *National Electrical Code (NEC)* covers the installation of electrical equipment in public and private premises.
 - Product standards requirements are in accordance with the *NEC*.
- The *NEC* is a consensus code published by the National Fire Protection Association.
 - This is NOT a national standard, but it is widely adopted as law by state and local municipalities.

Multipronged (360°) Safety Approach

360° Case Study: Ingestions of small batteries (like button and coin cells) were causing serious internal injuries, sometimes resulting in deaths.

- Button/coin cell batteries lodged in the esophagus can cause electrical current to hydrolyze fluid, leading to hydroxide burns.
- Can lead to severe injuries and death in as little as 2 hours
 - Victims can present nonspecific flu-like symptoms
 - Delayed treatment causes fistulas, perforations, necrosis, stricture, and vocal cord paralysis.



Multipronged Safety Approach

360° Case Study: Button/coin cell battery ingestions

1. Educate consumers on the hazard
2. Improve battery compartment design
 - Require a screw or two independent simultaneous motions to access battery
3. Improve packaging
 - Child resistant packaging
4. Improve warning copy or labeling
 - Hazard
 - Message
5. Improve battery design to mitigate or remove the hazard

Multipronged Safety Approach

360° Case Study: Button/coin cell battery ingestions

Voluntary Standards

- Button/Coin cells are used in more than 50 product categories that have a voluntary standard
- Only four standards have the requirement to prevent access by children
 - ASTM F963 *Toy Safety*;
 - ASTM F2923-11 *Children's Jewelry*
 - UL 60065 *Audio Video Equipment*
 - UL 4200A *Products Incorporating Button Cell Batteries of Lithium or Similar Technologies*
 - New horizontal standard will be adopted by other product standards .

Follow Best Practices – Comply with Technical Regulations

Case Study #1: This hair dryer is missing an immersion-detection, current-interrupter (IDCI) plug and presents a risk of electrocution if dropped in water. It violates the requirements under 16 C.F.R. section 1120.3(a) .

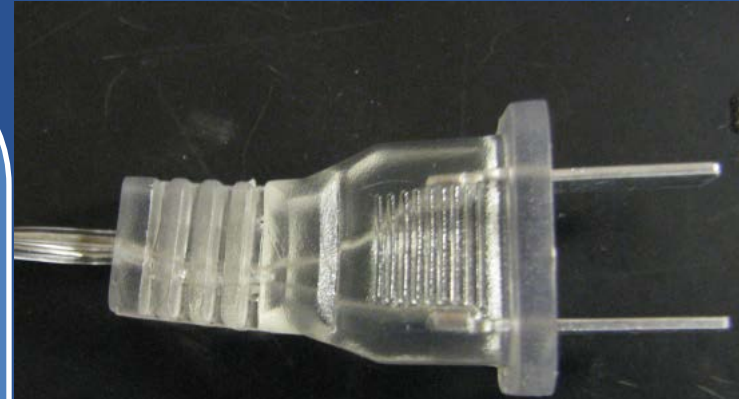
CBP seized products at the port.



Follow Best Practices – Comply with Voluntary Standard

Case Study #2: Uncertified decorative lighting string did not meet UL 588 requirements; wire was undersized, plug lacked overcurrent protection, strain relief was inadequate, and circuit enclosure was not flame resistant. Posed fire and shock hazard.

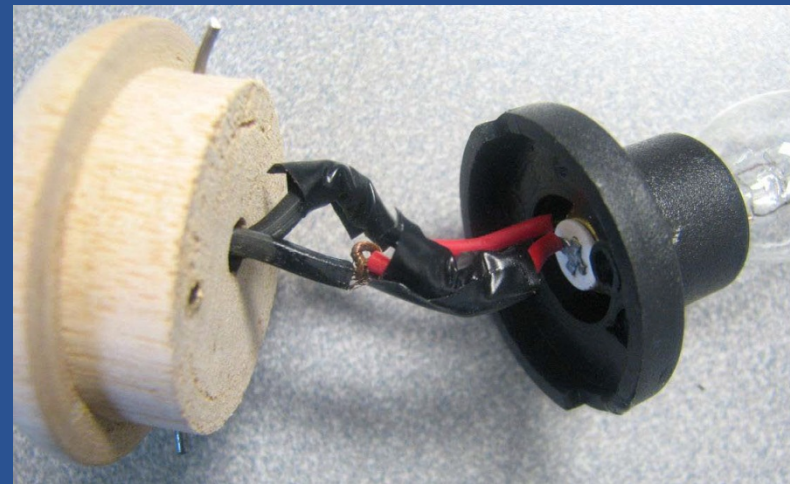
CBP seized units at port.



Follow Best Practices – Comply with Voluntary Standard

Case Study #3: Uncertified luminaire did not meet UL 153 requirements; it was assembled with poor workmanship, lacked proper strain relief on the power cord, and did not have a polarized plug. Posed fire and shock hazard.

CBP seized units at port.



Follow Best Practices – Comply with Voluntary Standard

Case Study #4: Uncertified handheld work light did not meet UL 153 requirements; deficiencies included assembly with poor workmanship, undersized wire, inadequate strain relief on the power cord, and substandard components. Posed fire and shock hazard.

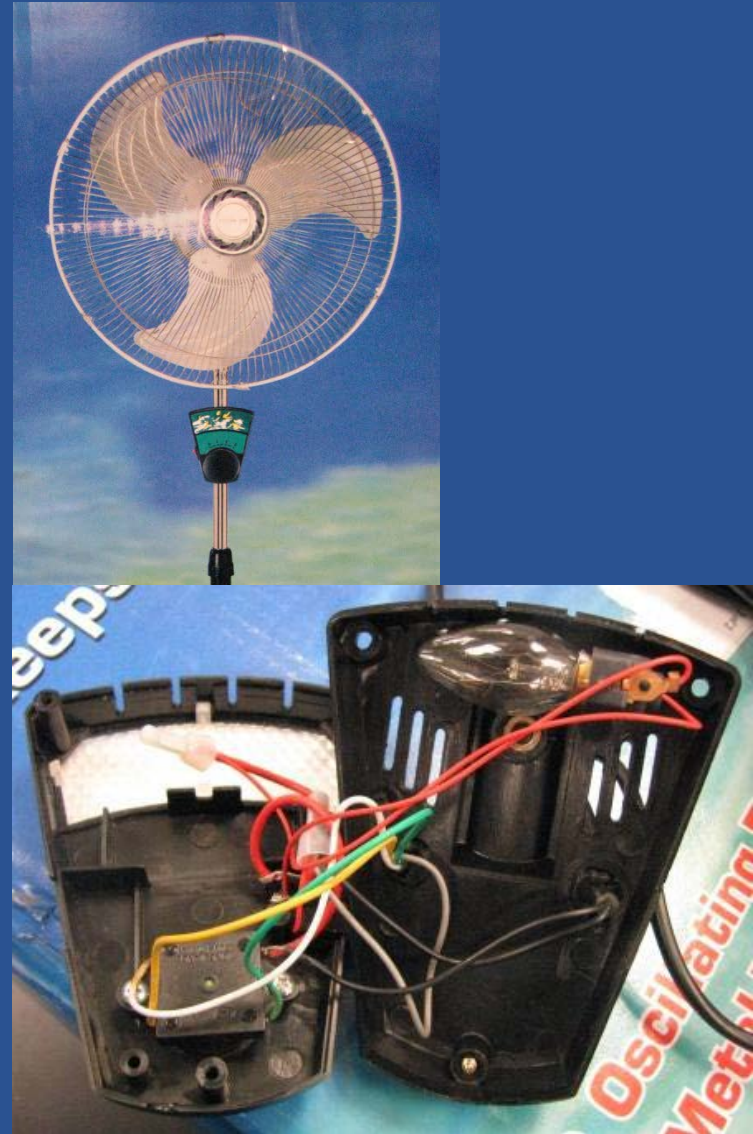
CBP seized units at port.



Follow Best Practices – Comply with Voluntary Standard

Case Study #5: Uncertified portable electric fan did not meet UL 507 requirements; deficiencies included motor without thermal protection, undersized wire, inadequate strain relief on the power cord and lack of integral overcurrent protection in plug. Posed fire and shock hazard.

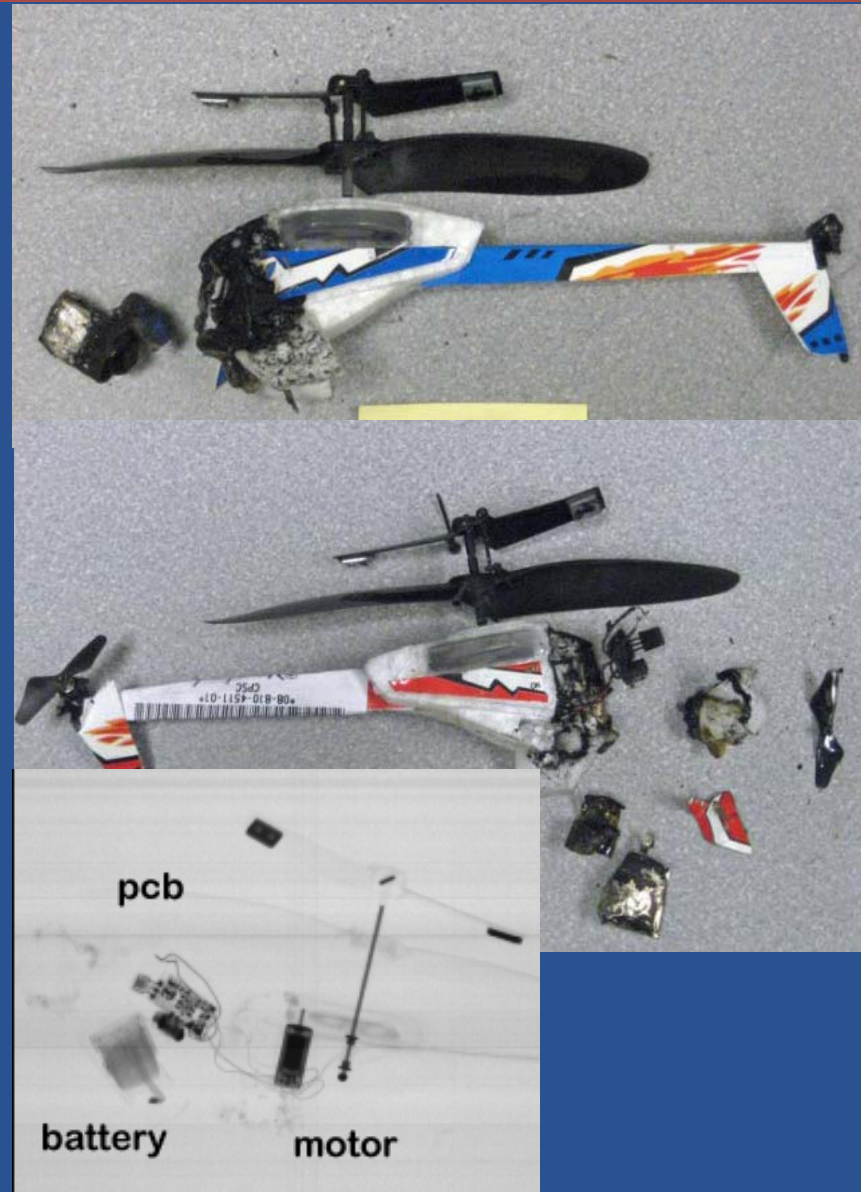
CBP seized units at port.



Follow Best Practices – Use Certified Parts

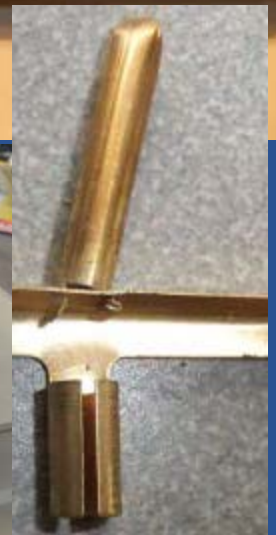
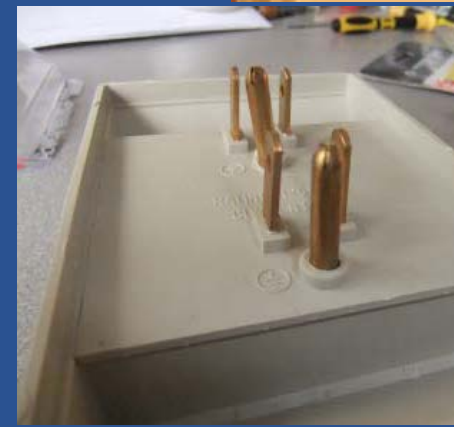
Case Study #6: Remote control toy helicopters provided with rechargeable lithium-ion batteries without charge/discharge control circuitry or thermal protection, allowing batteries to be overcharged or over-discharged, overheat, and ignite. Posed fire hazard.

Units recalled.



Follow Best Practices – Comply with Voluntary Standards

Case Study #7: Uncertified six-outlet current tap did not meet UL 498A. It was poorly constructed from inadequate materials. Sheet metal was too thin and flimsy, lacking strength to contact plug blades properly. Resulting loose connections can arc and overheat. Ground pin was poorly fastened to grounding bus. Unit posed fire and shock hazard.



CBP seized units at port.

Follow Best Practices – Comply with Voluntary Standards

Case Study #8: Uncertified power strip was not compliant with standard. Power cord and internal wiring were severely undersized, and the cord strain relief was inadequate. Sheet metal busses were too thin and flimsy and deformed when a plug was inserted. Internal connections were poorly made and easily came loose. Unit posed fire and shock hazard.

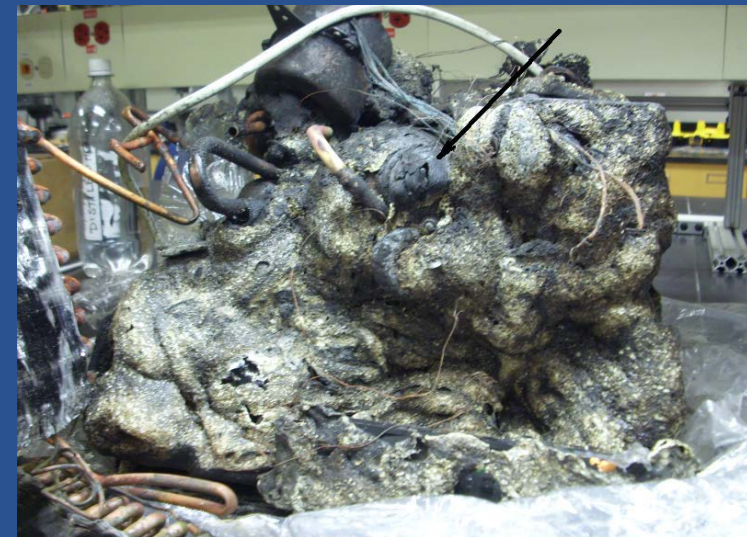
CBP seized units at port.



Follow Best Practices – Maintain Quality Control Processes

Case Study #9: Third party-certified dehumidifier involved in fire incidents. Poor recordkeeping and failure to follow process controls allowed non-flame-resistant plastic resins to be used in enclosure molding in place of approved polymeric material. Insufficient flame resistance allowed internal failure to ignite surrounding plastic and propagate flames beyond unit.

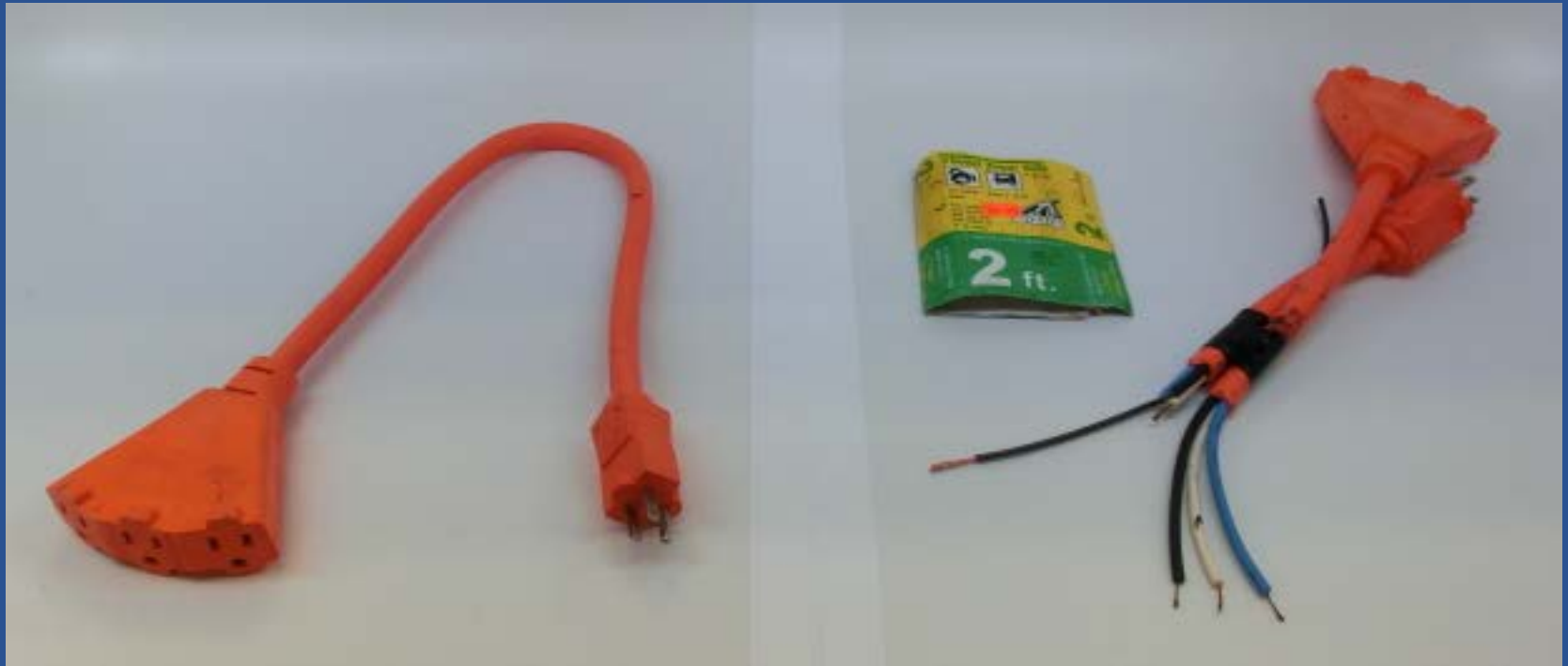
2 million units recalled.



Follow Best Practices – Maintain Quality Control Processes

Case Study #10: Uncertified power cord. Undersized wiring.

CBP seized units at port.



Summary

Electrical safety requires diligence from producer to user.

- Be aware of and comply with CPSC Technical Regulations.
- Specify products that have been designed and manufactured in accordance with applicable voluntary standards.
- Obtain products and components with third party certification from an accredited laboratory.
- Only procure from manufacturers who follow best practices to ensure products are built consistently and with proper quality and safety.

For more information, please visit

WWW.CPSC.GOV

Any
questions?

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