Dist 2/2/00

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

CPSC/OFFICE OF THE SECRETARY
2000 FEB -2 A 9:35

Vote Sheet

Date: JAN 31 2000

TO : The Commission
Sadye E. Dunn, Secretary

FROM : Michael S. Solender, General Counsel MSS
Stephen Lemberg, Asst. General Counsel SL
Harleigh Ewell, Attorney, GCRA (ext. 2217) HE

SUBJECT : Options on Petition CP 99-1 to Ban, or Require Warning Labels and Instructions for, Steel Electricians' Fish Tapes

Attached is a staff briefing package discussing options concerning whether the Commission should grant or deny the subject petition. The staff recommends that the Commission deny the petition. A draft letter of denial, for the Commission's consideration, is included at Tab C of a memorandum from the Office of General Counsel that has been forwarded separately to the Commission.

Please indicate your vote on the following options.

I. DENY THE PETITION AND APPROVE THE DRAFT LETTER OF DENIAL WITHOUT CHANGE.

_____ _____
(Signature) (Date)

II. DENY THE PETITION AND APPROVE THE DRAFT LETTER OF DENIAL WITH CHANGES (please specify).

_____ _____
(Signature) (Date)

CPSA 6 (b)(1) Cleared
1/31/00
No Mfrs/PrvtLblrs or Products Identified Excepted by AtReady

III. GRANT THE PETITION.

_____ _____
(Signature) (Date)

IV. TAKE OTHER ACTION (please specify).

_____ _____
(Signature) (Date)

Attachment

Comments/Instructions:

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: JAN 31 2000

TO : The Commission
Sadye E. Dunn, Secretary

THROUGH: Michael S. Solender, General Counsel MSS
Pamela Gilbert, Executive Director PG

FROM : Ronald L. Medford, Assistant Executive Director, Office of Hazard RLM
Identification and Reduction
Mohammed Khan, Project Manager, Directorate for Engineering Sciences MK

SUBJECT : Petition CP 99-1, Steel Fish Tape

I. INTRODUCTION

This memorandum discusses the issues regarding Petition CP 99-1, which asks the Commission to either consider a ban for steel fish tapes or to implement regulations for warning labels and instructions. This memorandum provides information for the Commission to consider in determining whether the product poses an unreasonable risk of injury.

II. BACKGROUND

A fish tape is a hand-held, manually operated tool that is commonly used by electricians, installers of heating, ventilating and air conditioning (HVAC) systems, and installers of commercial and residential security systems to pull, or "fish" electrical supply wires and other cables through conduits and wall spaces. Most commonly purchased fish tapes are enclosed in plastic reels with winders to facilitate user control and are available in a variety of lengths, ranging from 25 to 300 feet. Steel fish tapes have been in consumer use since the late 1960's. Since the mid-1970's, electrically nonconductive fish tapes (typically of nylon, fiberglass, or nylon-coated fiberglass) have been available.

A submission from John C. Stein, of the Boccardo Law Firm LLP, was docketed as Petition CP 99-1 on May 18, 1999. (Petition CP 99-1 is available from the U.S. Consumer Product Safety Commission's Office of the Secretary.) The petitioner requests the Commission to consider banning steel fish tapes or effecting strict regulations for warning labels and instructions with regard to its potential use. The petitioner had represented the family of a man who was electrocuted in his home in 1995 while handling a steel fish tape. The information

submitted by the petitioner indicates that the victim was in his attic, "fishing" stereo speaker wires through wall spaces.

According to the petition, in particular the declaration of Mr. Fred C. Holmes, an expert witness (petitioner's exhibit no. 4), the consumer contacted an energized junction box in the attic and simultaneously contacted an electrical ground via the steel fish tape. Mr. Holmes further explains that the steel fish tape, "...created a path for the electricity to flow from the incident junction box through [the consumer] and into the metallic fish tape to the ground that caused [his] unfortunate incident." Mr. Holmes indicates that the junction box was energized by a live wire that had been improperly installed in the junction box.

The Commission published a notice in the Federal Register on June 7, 1999, requesting comments on the petition. One comment was received. The comment supported the petition and was submitted by the law firm of Blumenstiel, Huhn & Adams in Columbus, Ohio. (The comment is available from the Commission's Office of the Secretary, docket no. CC 99-3.) The law firm represents an electrical contracting company employee who was injured while using a steel fish tape. The comment included an investigation summary and citation of penalties from the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA). The OSHA report indicates that, on July 14, 1998, the employee was, "...feeding a steel tape (fish line) through a 1 inch conduit located in a 480 volt switch box when the steel tape came in contact with the bus bar." The employee suffered burns covering 20% of his body.

III. DISCUSSION

A. Product Description and the Potential Hazards

A fish tape is a hand-operated tool that facilitates electricians, home improvement contractors, installers of telecommunications, HVAC, and security systems, and "do-it-yourselfers," in pulling or "fishing" wires through conduits and other normally inaccessible building spaces. A fish tape is a spool of long, thin, flexible rod or cable, which includes a leader or "hook" at its beginning to hold wires and cables while they are pulled. Most fish tapes, used by tradespeople and consumers alike, are constructed from steel. Common steel fish tapes have a rectangular cross section (typically, 0.125 x 0.060 inch), whereas others can have a circular cross section (typically, 0.1875 inch diameter) made of wound multi-strand steel cable. An example of a typical steel fish tape with integral plastic spool housing is shown in Figure 1.

The potential hazard associated with the use of a steel fish tape is electric shock. A steel fish tape poses a hazard of electric shock for two reasons: (1) it is specifically designed to reach into building spaces where it is likely to contact concealed energized components; and (2) it conducts electricity. Furthermore, as illustrated by the improper wiring inside the junction box of the consumer's home reported by the petitioner, the electrocution hazard associated with a steel fish tape can be compounded by the condition of the existing electrical system.

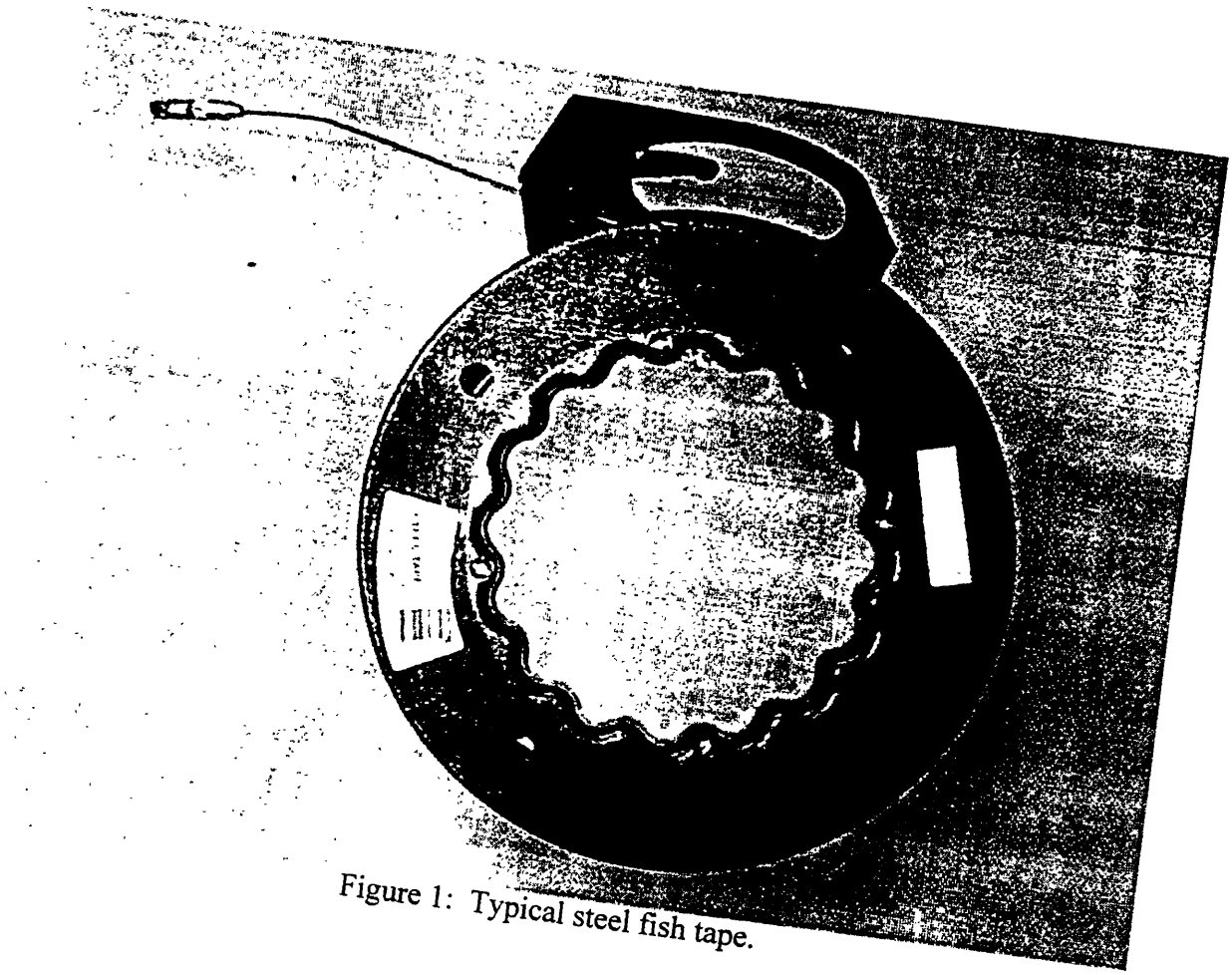

Figure 1: Typical steel fish tape.

Electric shock incidents can result in injuries or deaths when a person's body becomes a part of a closed electrical circuit. An individual can become part of a closed electrical circuit if his/her body provides a physical connection between circuit components (e.g., wires, switches, bus bars, terminals, etc.) or between a circuit component and a grounding source (e.g., ground wire, conductive conduit, metal plumbing, HVAC ducts, etc.). Simultaneous contact with an energized wire and an electrical ground constitutes a closed circuit and establishes the conditions for a potential incident.

Steel fish tape coming in direct contact with energized components is the primary way for such an incident to occur. Although typical steel fish tapes are encased in electrically nonconductive plastic reels, the potential for electrocution is not removed since the user must handle the metal tape to unreel it and "fish" it through spaces. Also, a common steel fish tape feature is a hook at the connecting end that can snag and nick wires previously installed inside the conduit, resulting in a potential electric shock hazard.

The risk of an incident with a steel fish tape can be completely removed if all sources of electrical power are disconnected. However, de-energizing electrical circuits may not always be feasible or assured in all instances. For example, the fish tape user may require electricity for lighting and power tools in some work scenarios. To accommodate this need, the user may need to leave some electrical circuits energized.

B. Incident Data

The Directorate for Epidemiology, Division of Hazard Analysis (EPHA) has performed a review of all known incidents, provided at Tab A, including the consumer's death reported in the petition and the incident reported in the comment to the Federal Register notice. EPHA's searches for consumer incidents included the following databases:

1. The Injury and Potential Injury Incident File (IPII)
   (submission dates from 01/01/90 through 09/14/99).
2. The In-depth Investigation File (INDP)
   (incident dates from 01/01/90 through 09/14/99).
3. The Death Certificate File (DTHS)
   (incident dates from 01/01/90 through 09/14/99).
4. The National Electronic Injury Surveillance System (NEISS)
   (incident dates from 01/01/90 through 12/31/98).

Relevant consumer incidents were not found in the CPSC databases. However, a number of relevant worker-related incidents, documented by OSHA, were found in the IPII database. These incidents were either deaths or injuries and occurred between 1987 and 1998. The data were analyzed to determine if use of a steel fish tape was the underlying element for a death or injury. A total of 5 deaths and 14 injuries over this 12 year period were identified from the petition, the Federal Register notice comment, and the IIPI database. All of these incidents, with the exception of the consumer incident from the petition, happened in the workplace and were investigated by OSHA. (Note: The incidents contained in the IPII database are reported voluntarily and unreported cases may exist.) The following summarizes the death and injury information.

1. <u>Deaths</u>

The data analysis indicates four occupational deaths were caused by the fish tapes' direct contact with energized electrical components. These occurred between 1987 and 1998. In addition, one consumer death in 1995, mentioned in the petition, resulted when the fish tape established a pathway to an electrical ground. Two of the occupational deaths occurred because the workers thought the electrical power had been removed from the circuits.

2. Injuries

The OSHA data found in the IPII database indicate that 14 injuries resulted from steel fish tapes contacting energized electrical components. No such injuries were found in the NEISS or DTHS databases that involved consumers. The reported injuries included electric shock and burns to the hands, arms, and upper torso. In one incident, an electrical worker suffered second and third degree burns over 35% of his body.

C. Health Sciences

The Directorate for Health Sciences' (HS) memorandum, at Tab B, details the physiological impact of injury caused by electric shock. The report indicates that the most common cause of death resulting from an electric shock is ventricular fibrillation that leads to cardiac arrest. Permanent brain damage may occur if a victim of cardiac arrest is not resuscitated quickly. HS also states that an electrical current as low as 50 milliamperes (mA) at 60 hertz (Hz) can produce fibrillation in just seconds. Currents greater than 50 mA can be generated in electrical incidents occurring in consumer residences. In their memorandum, HS concluded, "The consequences of electrical incidents can be severe and include death by electrocution. This product, when used in conjunction with a situation that lends itself to an electrical incident (e.g., an improperly wired junction box), could increase both the risk of occurrence and severity of the incident. For this reason, use of non-conductive fish tapes, which are available to consumers, should be considered as an alternative."

D. Economics

The memorandum from the Directorate for Economic Analysis (EC), at Tab C, includes product background information, market sales figures, and a preliminary projection of the potential benefits associated with a ban. According to the EC report, fish tapes have been in consumer use since the 1960's and the "do-it-yourself" (DIY) home improvement retailers sell them directly to consumers. Steel fish tapes (ones enclosed in plastic reels) are offered for about $40 to $100, primarily depending upon the length.

Nonconductive fish tapes have been available since the mid-1970's. Current nonconductive units cost about twice as much as their steel counterparts and represent 20% to 25% of the total sales volume. There are three primary manufacturers of fish tapes and they produce both steel and nonconductive fish tapes. The industry sources report that perhaps 750,000 fish tapes are sold each year. It is estimated that steel units constitute 75% to 80% of the total sales and retail sales account for 10% to 25% of the total sales. It should be noted that DIY retail sales are likely to include some contractor purchases.

The memorandum from EC states that based on preliminary information, requiring nonconductive fish tapes would result in increased costs to consumers of $40 or more per unit, as all consumers would have no choice but to purchase the more expensive nonconductive tapes instead of the less expensive steel tapes. EC also says that it appears that the costs of a ban of

steel fish tapes would be, at minimum, some 12 times the benefits derived from such a ban ($3.35 in benefits per otherwise-steel unit compared to $40 in increased cost to consumers).

E. Compliance

The Office of Compliance, Recall and Compliance Division (CRC) indicates, at Tab D, that it has no record of consumer incidents involving steel fish tapes. However, CRC states it has reviewed a small number of complaints that all occurred in "commercial/industrial settings." Since these complaints involved commercial settings, investigations were not initiated.

F. Human Factors and Engineering Analysis

1. Human Factors Assessment

At Tab E, the Division of Human Factors (HF) staff has provided an incident analysis that discusses how the consumer who died used the steel fish tape in his attic, and the potential effectiveness of written warnings for steel fish tapes. HF staff points out that five different events had to occur to establish the fatal conditions in the consumer's attic; "1) the victim was electrically grounded without realizing it, 2) the fish tape contacted a junction box or some other grounding source within a generally large volume of open space, 3) a live conductor was touching the metallic junction box, 4) the junction box was not electrically grounded, 5) the junction box was energized.

2. Applicable Standards

The Directorate for Engineering Sciences (ES) staff conducted a worldwide standards search and found that standards for safety, performance, or design do not currently exist for fish tapes. However, the fish tape involved in the incident reported in the petitioner's request incorporated a warning label. The warning label read as follows: "Warning! Use of this product on or near energized electrical circuits or components could result in serious personal injury or death." Such warning labels are within the scope of the American National Standard for Product Safety Signs and Labels, ANSI Z535.4.

3. Warning Label Assessment

The Division of Human Factors (HF) staff stated in its memorandum (Tab E) that the label on the incident fish tape did not conform exactly to the recommendations in the standard. For example, the label on the incident sample used the signal word "Warning", which, according to ANSI Z535.4, is used for indicating *potentially* hazardous situations if not avoided. The signal word "Danger" is used for situations that are *imminently* hazardous if not avoided which is the case when using fish tape. Furthermore, the label on the product involved in the incident did not explain how to avoid the hazard. The HF staff reviewed the warnings on other available fish tapes on the market and generally found they also do not conform to the recommendations in ANSI Z535.4. The HF staff summarized the elements that must be included in a label that

conforms to the standard: 1) a clear statement of the hazard, 2) a statement of the consequences, and 3) a statement on how to avoid the hazard. HF believes the words "Electrocution Hazard" concisely delineates the hazard, and the phrase "Turn off power to switches and outlets that could be contacted by tape" provides an effective means for avoiding the hazard. The HF staff also pointed out that the color "red", in accordance with the ANSI standard, would assist in capturing the consumer's attention and is usually associated with the signal word "Danger". The HF staff stated that it, "...believes that while an improved label meeting the provisions of the ANSI standard could marginally improve a consumer's awareness of the hazard, it would not eliminate the potential for electrocution." HF also stated that in situations where the consumer cannot take reasonable actions to eliminate the hazard, alternatives other than labeling should be considered.

4. Alternative Designs

As mentioned in the EC memorandum, electrically nonconductive fish tape materials are available on the market today as alternatives to steel. These include nylon, fiberglass, and combinations of nylon and fiberglass. These materials are selected and manufactured to perform equally to steel fish tapes but nonconductive fish tapes currently cost twice as much as steel units. Nylon and fiberglass fish tapes are impervious to rusting, which is the most common failure mode for steel fish tapes. ES discussions with representatives from the International Association of Electrical Inspectors, manufacturers, and tradespeople, however, indicate that under long-term repeated normal use, the metallic leaders or features at the end of nonconductive fish tapes used to secure wires and cables can disconnect from the nylon or fiberglass. Steel fish tapes are, therefore, considered more reliable but the industry sources could not provide to ES data that compare the failure rates of steel and nonconductive fish tapes.

The industry sources say that a nonconductive fish tape, because of its greater flexibility, allows the user to better negotiate turns or conduit bends and is preferred when "fishing" short conduit runs of less than 100 feet. The industry sources also state that a steel fish tape allows for increased control and ease of use when "fishing" long conduit runs because of its higher rigidity and superior compressive resistance over nylon or fiberglass.

ES believes that there is little difference between the designs from a consumer's standpoint, because most homes typically do not have conduits as part of their electrical systems and the distances are typically less than 100 feet.

G. CPSC's Authority

The majority of known deaths and injuries associated with steel fish tapes occurred in occupational settings. This raises the question of whether the Commission has authority to regulate this product in view of Section 31(a) of the Consumer Product Safety Act. That section states that CPSC has no authority "to regulate any risk of injury associated with a consumer product if such risk could be eliminated or reduced to a sufficient extent by actions taken under the Occupational Safety and Health Act of 1970 ...." 15 U.S.C. § 2080(a). For the reasons stated in its separate memorandum to the Commission, the Office of General Counsel (OGC) concludes that, based on the currently available information, Section 31(a) of the CPSA would not prevent the Commission from regulating steel fish tapes.

IV. OPTIONS

1. Grant the Petition

Should the Commission determine that the information contained in this briefing package indicates that there may be an unreasonable risk of injury associated with steel fish tapes sold for consumer use, and that a rule may be reasonably necessary to eliminate or adequately reduce such risk, the Commission may grant the petition and direct the staff to develop an advance notice of proposed rulemaking (ANPR).

2. Deny the Petition

Should the Commission find that the information contained in this briefing package does not provide sufficient justification to grant the petition, the Commission may deny the petition.

3. Defer the Petition

Should the Commission require information in addition to that contained in this briefing package to determine whether the petition should be granted or denied, the Commission may defer its decision and direct the staff to develop a project to collect the additional information.

V. CONCLUSIONS AND RECOMMENDATIONS

The information provided in this briefing package indicates that the users of steel fish tapes can be unknowingly exposed to hazardous electrical conditions when proper precautions are not taken. However, despite the estimated annual sales of about 600,000 steel fish tapes and a growing "do-it-yourself" market, the number of incidents has remained low. In fact, since the late 1980's, the Commission is aware of only one incident involving the use of this product by a consumer. This was the death that the petitioner reported. Most steel fish tapes sold have warning labels, as discussed by the Commission's Human Factors staff, that are not in exact compliance with the ANSI standard for labeling (ANSI Z535.4). While not eliminating the potential for electrocution, the staff believes that improving the labels to meet the provisions of the standard could marginally increase consumers' awareness of the hazard.

Based on its analyses, the staff recommends that the Commission deny the petitioner's request, but recommends the Commission direct the staff to request the manufacturers to voluntarily develop and implement improved warnings that satisfy the provisions of the labeling standard.

TAB A

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: JAN 31 2000

TO : Mohammed Khan
Project Manager, Steel Electricians' Fish Tapes Petition
Division of Electrical Engineering
Directorate for Engineering

THROUGH: Susan Ahmed, Ph.D.
Associate Executive Director
Directorate for Epidemiology

Russell H. Roegner, Ph.D.
Director
Division of Hazard Analysis
Directorate for Epidemiology

FROM : Jean C. Mah, EPHA

SUBJECT : Petition CP 99-1, Fish Tapes

This memorandum is prepared in response to *Petition CP 99-1 for a Ban of, or Warnings and Instructions for, Steel Electricians' Fish Tapes*. It summarizes the data available on deaths and injuries associated with steel electricians' fish tapes.

Background

A fish tape is a manually operated tool used to pull, push, or generally "fish" one or more wires or cables through a conduit pipe or other narrow space that is not otherwise accessible. It consists of a long, thin, flexible rod or cable and has a hook on one end which attaches to the wire or cable being "fished". Fish tape often comes in a plastic housing and can be reeled in when not in use. In addition to steel, fish tapes are also manufactured from nonconductive materials, such as nylon or fiberglass.

The submitted petition cites as its basis the death of a 36 year-old male consumer, who was electrocuted while using steel fish tape to string stereo speaker wires through the attic of his home. While contacting the fish tape, the consumer simultaneously contacted an energized junction box. As a result, he acted as the only connection between the positively charged conductor (junction box) and a neutral conductor (steel fish tape), causing the electric current to enter his body and resulting in his death. A warning label on the housing of the fish tape

indicated that "Use of this product on or near energized electrical circuits or components could result in serious personal injury or death."[1]

The petitioners indicate that they requested a search of CPSC databases, which at that time did not yield any cases related to fish tapes. The petitioners also state that a subsequent search of the federal Occupational Safety & Health Administration (OSHA) database yielded "approximately 14 electrocutions involving many fatalities," over the last 10 years. Five occupational case summaries are included in the petition: two documented by the National Institute for Occupational Safety and Health (NIOSH) and three documented by OSHA. In the course of researching the petition, CPSC staff found that two of these cases were actually a single incident that had been documented by both NIOSH and OSHA. One additional OSHA case involving a steel fish tape was submitted as part of the public comment process for the petition.

Therefore, the petition and comment collectively provided 6 distinct incidents for analysis by CPSC staff.

CPSC Search Methodology

CPSC staff conducted systematic keyword searches for incidents associated with fish tape submitted roughly within the past ten years. The following CPSC databases were searched:

- Injury and Potential Injury Incident File (IPII)
- In-Depth Investigation File (INDP)
- Death Certificate File (DTHS)
- National Electronic Injury Surveillance System (NEISS)

(See Attachment A for the respective search criteria.)

As a result of these searches a total of 11 additional incidents, where fish tapes were involved as an electrocution hazard, were found in the IPII database. The IPII database is compiled from sources such as newsclips, consumer complaints, Medical Examiners and Coroners Alert Program (MECAP) reports, and letters from lawyers. These incident reports help describe usage and potential hazard patterns. Incidents contained in IPII are not from a random probability sample, and therefore cannot be considered representative of all fish tape incidents. None of the incidents found were assigned in-depth investigations, and no relevant incidents were found in the other databases.

Combining these incidents with data provided in the petition and comment, CPSC staff is aware of 17 incidents (6 + 11) in which fish tapes posed an electrical hazard.

Review of Incidents

In most incidents, the material of the fish tape was specified and described as "steel", "metal", or "conductive". No fish tapes were specified as nonconductive. In some cases where material was not specified, CPSC staff determined that steel fish tapes were used based on the injury scenarios.

A summary of the available data is presented in the table below:

	# Incidents	# Deaths	# Injuries
Totals	**17**	**6**	**29**
Equipment Malfunction Only	1	1	15
Electric Shock	7	4	3
Burn from Electrical Arc	9	1	11

One incident occurred where the conductivity of a fish tape was involved in equipment malfunction but not in the subsequent injury scenario. A fish tape in use accidentally contacted an energized meter base, causing a short in the fuses that controlled lighting in the room. In order to restore the lighting, a worker tried to bypass the circuit breaker by attaching jumper wires to the fuse terminals. He misjudged the effect of the short on one of the terminals, and as a result, connected the jumper between two energized terminals. The resulting electrical arc caused an explosion and subsequent fire which resulted in one fatality and 15 injuries.[22]

The remaining 16 incidents, consisting of 1 consumer incident and 15 occupational incidents, involved electrical hazards which caused injury or death. These incidents occurred between 1987 and 1998 and involved 19 victims. Five fatalities and 14 injuries occurred, with 10 of the injuries requiring hospitalization. Seventeen of the victims were male, while 2 were female, and victims' ages were between 21 and 55. Victims in occupational incidents worked as the following: supervisory electricians, journeyman electricians, apprentice/helper electricians, construction laborers, and installers of special equipment.

Summary of Injury Scenarios

Electric Shock

The incident serving as the basis for the petition, and the only consumer incident, involved a fatality due to electric shock. In this incident the fish tape did not directly contact energized parts; however, when the consumer touched an energized junction box while also in contact with the fish tape, the fish tape acted as a neutral conductor, drawing the electrical current through him. In the other 15 incidents, injury was sustained when a fish tape directly contacted, or passed over, energized equipment. Although a label on the fish tape indicated that "serious injury or death" could result if the product was used near energized parts, it is not known whether the consumer had taken steps to de-energize his work area.

In the three other fatal electrocutions, workers were using fish tape to pull wires through conduit pipe.[7,8,10] The tapes contacted energized parts, such as conductors that already existed in the conduit, and became energized. However, in two of these incidents, the victims mistakenly believed that they had de-energized the equipment when this was not actually the case. One incident occurred after two workers reportedly turned off the circuit breaker and tested the conductors to ensure de-energization. It began to rain, and one worker picked up a fish tape

attached to the conductors. However, the conductors were energized, and as the worker stepped from a concrete surface onto the wet grass, he was electrocuted.[7] In the other incident, a worker turned power off at the circuit breaker before attaching a set of conductors to a fish tape. However, due to poor labeling, the power for this set of conductors was not turned off, and the worker was electrocuted when the conductors contacted the fish tape.[8]

Three electric shock incidents occurred similarly to the above incidents, but were not fatal. In one incident, a worker was fishing conductors for an air-conditioning system when the fish tape contacted an energized connecting bolt on the main breaker, causing him to temporarily lose consciousness from the resulting electric shock.[11] In the other two incidents, workers received shocks when the fish tape they were using contacted 480 volt bus bars.[9,12]

Electrical Arcing

A fatal incident occurred when two fish tapes were used to pull wires through a conduit to a main panelboard which was energized.[13] One fish tape had gotten stuck partway through the conduit, and a worker was inserting a second fish tape from the opposite end of the conduit in an attempt to hook the first fish tape and pull it the remaining distance through the conduit. Despite a helper's efforts to steady this second fish tape away from an energized bus bar, the tape contacted it, and the resulting arc burned both workers and ignited the first worker's clothing. The first worker eventually died of his injuries. The incident took place at a plant that was in the final stages of construction.

Eight additional incidents ending in injuries were due to fish tape contacting or nearly contacting energized equipment, such as bus bars or conductors. The resulting electrical arcs caused thermal burns to workers in the immediate proximity.[14-21] Injuries from exposure to arcing ranged from first to third degree thermal burns and affected parts of the body including the face, hands, arms, and upper torso. In one incident, an electrical worker suffered 2nd and 3rd degree burns over 35% of his body.[18] Another of these incidents occurred at a construction site.[14] A minor injury occurred as a worker was winding up the tape to put it away. As it was being wound, the tape slid behind the protective shield on an electric panel, resulting in a minor flashburn to the worker's face and hands.[15]

Conclusion

From the data available, it can be stated that the use of steel fish tapes while working on or around electrically energized parts or equipment has resulted in serious injury and death in one consumer and several occupational incidents. It is difficult to anticipate the potential electrical hazards of steel fish tapes to consumers based on a single consumer-related incident. Without CPSC investigative data on consumer-related incidents, staff cannot conclude the degree to which the occupational incidents simulate potential consumer scenarios. Steel fish tapes are carried by common retail outlets, where they may be purchased by consumers for home-improvement projects. While employers are subject to federal and state regulations concerning training, safety procedures, and protective equipment for their employees who work in electrical settings, consumers are not subject to such regulations if they perform electrical work in their

own residences. Even in occupational settings, CPSC staff is aware of incidents where workers tried to avoid electrical hazards by de-energizing their work area but failed, resulting in fatalities.

Attachment A

Search criteria for CPSC databases:

IPII

1st search
Date Entered between 1/1/1990 and 6/30/1999
Narrative contains "FISH TAPE"

2nd search
Date Injured between 1/1/1990 and 9/14/1990
Product Codes 803-893, 1803-1889, 4061-4063
Narrative contains "FISH", "STEEL", "SNAKE"

Note: Five incidents identified in the above systematic searches were excluded from the subsequent analysis. In these incidents, although fish tapes were present or the victims were in the act of "fishing" wire at the time, fish tapes were not involved as an electrical hazard.[2-6]

INDP

Date of incident between 1/1/1990 and 9/14/1999
Narrative contains "FISH", "STEEL", "SNAKE"

DTHS

1st search
Date of Death between 1/1/1990 and 9/14/1999
Product Codes 837, 881, 1876, 3223, 4062, 4063
Narrative contains "FISH", "STEEL", "TAPE", "ELEC", "WIR", "SHOCK"

2nd search
Date of Death between 1/1/1990 and 9/14/1999
Ecode = 9884
Narrative contains "FISH", "STEEL", "TAPE", "ELEC", "WIR", "SHOCK"

NEISS

Date of Treatment between 1/1/1990 and 12/31/1998
Product Codes 837, 881, 927, 1876, 3223, 4062, 4063
Diagnosis 46, 67
Narrative contains "FISH", "TAPE", "STEEL", "SNAKE", "LEAD", "LINE", "ELECTRIC"

Attachment B

[1] *Petition CP 99-1*: Mary Catherine Bernal, et al. Vs. Orchard Supply Hardware, et al., Superior Court of the State of California for the County of Santa Clara, September 23, 1997

[2] IPII document number I98B0021F

[3] IPII document number I98B0021R

[4] IPII document number I98B0021K

[5] IPII document number G9040169A

[6] IPII document number I98B0021O

[7] IPII document number I98B0021S; case included with petition

[8] IPII document number I98B0021Q; case included with petition

[9] IPII document number I98B0021A; case included with petition comment

[10] IPII document number I98B0021D

[11] IPII document number I98B0021H

[12] IPII document number I98B0021B

[13] IPII document number I98B0021L

[14] IPII document number I98B0021N

[15] IPII document number I98B0021J

[16] IPII document number I98B0021G

[17] IPII document number I98B0021C

[18] IPII document number I98B0021E

[19] IPII document number I98B0021I

[20] IPII document number I98B0021M

[21] IPII document number I98B0021P

[22] NIOSH FACE Report 86-52; case included with petition

TAB B

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: November 16, 1999

TO : Mohammed J. Khan, Engineer
Project Manager, Steel Electrician's Fish Tapes Petition
Directorate for Engineering Sciences

THROUGH: Mary Ann Danello, Ph.D., Associate Executive Director,
Directorate for Health Sciences
Lori E. Saltzman, M.S., Director,
Division of Health Sciences

FROM : Jason R. Goldsmith, Ph.D., Physiologist,
Directorate for Health Sciences, x-1387

SUBJECT : Petition CP 99-1 (Fish Tapes)

This memorandum is prepared in response to *Petition CP 99-1 for a Ban of, or Warnings and Instructions for, Steel Electricians' Fish Tapes.*

The product is a steel electrician's fish tape, used both by consumers and electricians to pull electrical wiring through spaces that are otherwise difficult to access. This petition arose as a result of the death of a consumer whose fish tape provided a path to ground when the consumer came into contact with a live circuit, resulting in his electrocution.

Health Sciences' staff has assessed the types of injuries that may occur as a result of an electrical incident (e.g., in the course of using a fish tape), and provided the discussion below. Throughout this memo, the term *electrical incident* shall be understood to mean an unexpected, unintentional and undesirable event involving electrical current.

DISCUSSION:

Although this product by itself poses little if any risk of personal injury, use of this product by a consumer for its intended purpose may increase both the risk of occurrence and severity of electrical incidents. This is due to the fact that this product is made of metal (steel), which is a conducting material (a medium through which electrical current may flow). Electrical incidents may produce asphyxia (loss of oxygen supply to vital tissues), burns, and/or paralysis.

Asphyxia, which can cause irreversible brain damage after a few minutes, results from three mechanisms.[1]

1) Electric current flowing through the brainstem can directly inhibit the respiratory center. If this occurs, breathing ceases, and may not resume when the electrical

contact is broken. This type of injury typically results from the head coming in contact with a conductor through which large currents (more than 1-2 amperes) are passing.

2) Electric current flowing across the chest can produce tetanic contraction of the muscles (sustained contraction of the muscle without periods of relaxation) involved in respiration, resulting in the cessation of breathing. If contact is broken quickly (less than 3-4 minutes), death from asphyxia may be avoided and breathing may reappear spontaneously, provided that ventricular fibrillation has not occurred. Currents of approximately 40-60 milliamperes (at 60 Hz) are required to inhibit respiration by this mechanism.[2]

3) Electric current flowing across the heart can produce ventricular fibrillation (the non-rhythmic contraction of the ventricular muscle fibers), the most common cause of death following an electric shock. If fibrillation occurs, and resuscitation is not begun promptly, cardiac arrest may ensue, followed a few minutes later by death. The likelihood of fibrillation occurring depends on the magnitude, duration, and frequency of the current. The current threshold for ventricular fibrillation is lowest for frequencies of 60 Hz, which corresponds to the frequency of the line voltage in the United States. Currents as low as 50-200 milliamperes (at 60 Hz) can produce fibrillation in a matter of seconds.[1] As the duration of the shock is decreased, higher currents are required to produce fibrillation; e.g., for a 1-3 millisecond shock, the current must be 1-2 amperes, and it must be presented at the appropriate phase of the cardiac cycle to produce fibrillation. If cardiac arrest occurs, perfusion of the brain (delivery of oxygen-carrying blood) ceases. Thus, even if resuscitation is successful, permanent brain damage may occur. There are no data available on the amount of current required to produce ventricular fibrillation in children; however, it is not likely that children will be users of this product.

Burns can also result from electrical incidents involving high voltages or currents and may be of two types[1]. Thermal burns may occur as a result of electric arcing or the ignition of flammable materials. If an arc is the result of a short circuit, current in the range of many thousands of amperes may flow. Electric burns result from the temperature rise that occurs when current flows through a resistance. Injury occurs when tissue temperature is elevated above the critical level for tissue damage by current flow. Obvious damage can be detected at the contact site, however, deeper damage, such as to muscle, will not always be readily apparent and may take days to manifest itself. Destruction of muscle, and the consequent release of intracellular muscle contents into the circulation, can lead to renal and cardiac failure. The relative contributions of thermal and pure electrical damage depend on the duration of electric current passage, the orientation of cells (within the various tissues of the body) in the current path, and their location. These parameters also determine the anatomic tissue distribution of injury.[3]

Finally, electric shock at 60 Hz can also produce tetanic contraction of the voluntary muscles, resulting in temporary paralysis. Consequently, the victim may be unable to remove himself from contact with the electrical hazard.

CONCLUSION:

The consequences of electrical incidents can be severe and include death by electrocution. This product, when used in conjunction with a situation that lends itself to an electrical incident (e.g., an improperly wired junction box), could increase both the risk of occurrence and severity of the incident. For this reason, use of non-conductive fish tapes, which are available to consumers, should be considered as an alternative.

---

[1] Howard, J.K. and F.H. Tyrer. Textbook of Occupational Medicine. Churchill Livingstone, Edinburgh, 1987.

[2] Bernstein, T. Effects of electricity and lightning on man and animals. Journal of Forensic Sciences 3: 3-11, 1973.

[3] Lee, R.C. Injury by electrical forces: pathophysiology, manifestations, and therapy. Curr Prob Surg 34: 677-764, 1997.

TAB C

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: January 28, 2000

TO : Mohammed Khan, ES

THROUGH : Warren J. Prunella, Associate Executive Director for Economic Analysis

FROM : Terrance R. Karels, EC TRK

SUBJECT : Fish Tapes

This is in response to Petition CP-99-1, by John C. Stein (March 29, 1999). The petition asks that the Commission ban the sale of steel fish tapes to consumers or require warnings regarding a possible electrocution hazard with these products. Fish tapes are used to "fish" wiring behind existing walls, reducing the need to directly access the interior space. There are no known government or industry data regarding the market for these products; in order to develop some preliminary market information on fish tapes, we contacted several manufacturers.

Fish tapes have been in widespread commercial use for about 75 years. They are used by electricians in commercial and residential settings. In recent years, these products have been used by professionals to install television and computer cable systems. They also have been in consumer use since the 1960s, driven partly by the increase in the do-it-yourself home improvement trend.

There are two types of fish tapes, steel tapes and nonconductive tapes (of nylon or fiberglass). Nonconductive tapes were introduced in the mid-1970s. Fish tapes are available in a variety of lengths, from 25 feet to 300 feet. Steel tapes are commonly sold for $40 to $100, depending upon the length. Based on examinations of manufacturer price lists, it appears that nonconductive tapes are about twice the cost of steel tapes of the same length.

The average useful life of these products is unknown, but manufacturers estimate that fish tapes can remain in service for as long as 20 years. Removal from use would be due to breakage rather than wearing out. The most common failure mode for these

products is rust or kinking (for steel tapes) or breaking (for nylon or fiberglass units). Misuse, such as using the tape as an auger to clear a stopped-up drain, can also cause failure.

Three manufacturers are considered to account for virtually all sales of fish tapes. They are: Greenlee Textron, Rockford, IL; Ideal Industries, Sycamore, IL; and Gardner Bender, Milwaukee, WI. Thomas & Betts Corporation, the firm mentioned by the petitioner, is reportedly a large producer of tools and building supplies but produces only a small number of fish tapes. All of these firms produce both types of fish tapes. Industry sources report that imports account for a small number of nonconductive fish tapes.

There are no official or trade statistics available for this product, and industry sources were reluctant to estimate overall sales of fish tapes. Based on a rather wide range of industry estimates (from a few hundred thousand units to over 1 million units), we estimate, that for the purposes of evaluating this petition, that perhaps 750,000 fish tapes are sold annually. Of these, some 75% to 80% were of steel. Retail sales account for an estimated 10% to 25% of total sales. Retail sales likely include some contractors, as well as consumers.

Staff reviewed relevant CPSC databases for the period 1987 through 1998, and found no consumer electrocutions involving fish tapes. The Directorate for Epidemiology reports that the CPSC databases do not allow for extrapolations as to whether there were any electrocutions prior to 1987 involving these products. The petitioner reported one consumer death, which occurred in 1995.

It is premature to conduct a final cost-benefit analysis at this time, since only preliminary information is available. However, using the rough data available, it seems likely that there would be considerable difficulty in making the cost-benefit finding that would be required by the Consumer Product Safety Act.

In order to provide a preliminary projection of the potential benefits associated with a ban, we assume that there was 1 fatality associated with consumer use over the previous 12-year period related to these products.

Based on previous sales estimates, we project that some 56,000 to 150,000 steel fish tapes are sold to consumers

annually (750,000 x .75 x .10 to 750,000 x .80 x .25). If past sales were at equivalent levels, and the tapes have a 20-year useful life, we would expect that perhaps 2 million units (the midpoint of consumer sales of 56,000 to 150,000 units, aggregated over 20 years) would have been available for consumer use at a given time. With 1 death over the last 12 years, and a statistical value of life of $5 million, the benefits of averting fish tape-related deaths (discounted at a 2.5% rate) would be about $3.35 per nonconductive unit that — but for a ban of steel fish tapes — would have been steel, over its expected useful life.

Based on preliminary information, requiring nonconductive fish tapes would result in increased costs to consumers of $40 or more per unit, as all consumers would be forced to purchase the more expensive nonconductive tapes rather than lower priced steel tapes. Based on this preliminary assessment, it appears that the costs of a ban of steel fish tapes would be, at minimum, some 12 times the benefits derived from such a ban ($3.35 in benefits per otherwise-steel unit compared to $40 in increased cost to consumers).

In addition to the calculated costs overwhelming the projected benefits, there would be some non-quantifiable loss of utility. There are some applications where steel fish tapes are preferable to nonconductive tapes (i.e., fishing cable over long distances); the choice of steel tapes over nonconductive units would be lost if steel tapes were banned.

TAB D

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: OCT 15 1999

TO : Mohammed Khan
Electrical Fish Tape Petition Coordinator
Engineering Sciences

THROUGH: Marc Schoem, Director
Recall & Compliance Division
Office of Compliance

FROM : Carlos L. Perez, Associate Director
Recalls & Compliance Division

SUBJECT : Electrical Wire Fish Tape Petition –Section 15 Activities

In the late 1980's, the Office of Compliance, Recall and Compliance Division, examined a very small number of complaints on electrical fish tapes. Based on review of the complaint information, incidents generally occurring in commercial/industrial settings, decisions were made that no investigational follow up was warranted by Commission staff. Further, no formal section 15 investigation has ever been opened on electrical fish tapes since that time.

TAB E

UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: December 27, 1999

TO : Mohammed J. Khan
Project Manager, Fish Tape Petition

THROUGH: Robert B. Ochsman, Ph.D., Director
ESHF

FROM : Terry Van Houten, ESHF

SUBJECT : Human Factors Response to Fish Tape Petition

Background

On May 18, 1999, a submission from John C. Stein was docketed as a petition under the Consumer Product Safety Act. The petitioner specifically requested that electrically conductive fish tapes either be banned or be required to carry written warnings alerting the consumer to de-energize electrical circuits in the work area.

The petitioner was counsel to the family of a consumer who was electrocuted during the use of one of these products. In the course of litigation, it was determined that alternative and non-conductive fish tapes are sold and, according to the petitioner, are equivalent in performance to the conductive variety. The petitioner also points out that the only means for communicating the potential hazard associated with steel fish tapes to consumers is through labeling. The petitioner states that the existing label on these products does not meet the recommendations of the American National Standard on Product Labeling (ANSI Z 535.4). The petitioner has also included the deposition of a qualified human factors expert who stated the label does not meet the basic elements of the ANSI voluntary standard.

The petitioner cites 14 fish tape electric shock injuries in the files of the Occupational Safety and Health Administration.

As stated by the CPSC Office of the General Counsel, the principal issue associated with this petition is whether steel fish tapes, with or without warnings and instructions, present an unreasonable risk of injury to consumers.

Human Factors Assessment

The following human factors discussion is broken down into two sections; how consumers use fish tapes, and the potential effectiveness of any written warnings that may be developed for these products.

Consumer Use of Fish Tapes

In the specific incident reported by the petitioner, a 36 year old attorney was attempting to string wires for stereo speakers through the attic in his home. While using a steel fish tape to pull the wires through the wall, he came in contact with a live circuit, and because the fish tape was in contact with grounded metal, he was electrocuted.

In this incident, there are a number of elements which require discussion. In order for an electric shock to occur, a person must become part of the electric circuit; that is, the person must simultaneously touch two conductors with sufficient voltage between the conductors. Only under these circumstances will an electrical shock occur. The victim was apparently in the attic pulling up on a steel fish tape connected to an electrical speaker wire. Stereo speaker wires normally operate at very low voltages and would not have been the source of the electrical hazard discussed here. At some point, the fish tape or the victim contacted a live conductor and simultaneously contacted an electrical path to ground. This would have resulted in a nominal voltage of 120 volts to ground if the electrical source were the residential electrical branch circuitry. There are a number of grounded metal objects in a typical attic such as metal air ducts, light fixtures, etc. In that environment, contacting these objects is almost unavoidable. In addition, the fish tape could have contacted a metallic receptacle or light switch box in the ceiling or wall. These are required to be grounded according to the National Electrical Code.

Except under extraordinary circumstances, conductors carrying household voltage are encased within an insulating material or enclosure. However, in the case under discussion, a live conductor was found to have been in contact with a metallic junction box and caused the box to become energized. Had the box been properly grounded, the household fuse or circuit breaker would have activated to open the circuit. For unknown reasons, the electricity was not turned off to that area of the house. It is likely that the victim did not realize that live conductors were in the vicinity. Further, unless he had actually tested the junction box for a ground, he would not realize that it was just the reverse, that is, energized. Therefore, in this incident, a number of events occurred to lead to the electrocution: 1) the victim was electrically grounded or touching the fish tape that was electrically grounded, 2) a live conductor was contacting the metallic junction box, 3) the junction box was not electrically grounded (a code violation), and 4) the victim contacted the energized box. If any of these four events had not occurred, the incident would not have taken place.

Human Factors believes that most consumers when working with electricity will take prudent safety precautions to the best of their ability. However, the consumer cannot foresee all aspects in the electrical system such as hidden boxes, or loose or exposed wires that still appear to be functioning normally. Further, the consumer is attempting to push a steel tape past a number of obstacles in the wall and generally is not aware of the location of the tape end. In this situation, the tape can bend or be diverted in unexpected directions resulting in contact with other potentially energized components. Wall receptacles and light switches may be controlled by two separate circuit breakers. If either the light switch or the wall outlet requires service, there will be a nearby source of power for a light. To do this type of work in a reasonable fashion, the consumer requires a source of light or power for a lamp. The easiest method to accomplish this is to leave one circuit on. This live circuit may follow an unknown pathway in the wall and

potentially energize some components in the path of the fish tape. Human Factors believes that most consumers would turn power off to either a light switch or a wall receptacle but not necessarily both.

In a similar manner, electrical codes permit a duplex wall receptacle to be energized and controlled from two separate circuits. With a break-off tab(s) removed, one receptacle of the outlet device can receive power from one circuit, and the other receptacle of the device could receive power from a different circuit. The rationale for this approach is to distribute the load to the duplex device over more than one circuit so as not to cause an overload condition. This wiring method is sometimes employed for kitchen counter receptacle outlets to accommodate the high power, portable cooking appliances like toaster-ovens, coffeemakers, grills, etc. Consumers may turn off a circuit breaker to what they believe is a single power wall receptacle leaving one circuit energized in the receptacle.

Effectiveness of Written Warnings

There is a warning label on the product involved in the incident, which reads as follows: "Warning! Use of this product on or near energized electrical circuits or components could result in serious personal injury or death." As has been mentioned, this label does not conform exactly to the provisions of the ANSI Z 535.4 standard. An examination of two other fish tapes, one metal and a second fiberglass, showed that the warning labels on these products also did not conform exactly to the ANSI standard.

In general, warning labels consist of three basic parts: 1) a clear statement of the hazard, 2) a statement of the consequences, and 3) a statement on how to avoid the hazard. As pointed out in the deposition, the means for avoiding the hazard is missing from the statement above. Human Factors agrees this is an important omission and suggests that including this as well as other changes could enhance the label.

According to the ANSI Z 535.4 standard, the signal word "Warning" is used for situations that are potentially hazardous if not avoided (Section 4.13.2). Alternatively, the signal word "Danger" is employed in situations that are imminently hazardous if not avoided (Section 4.13.1). In the present case, electrocution is the potential hazard and if not avoided, death, not injury could be the result. Therefore, Human Factors suggests that "Danger" is a more appropriate signal word. The color red is normally associated with the signal word "Danger" and use of this color in accordance with the ANSI standard would assist in capturing the consumer's attention.

Returning to the discussion of the basic elements of a label, Human Factors suggests that the words "Electrocution Hazard" would be a clear and concise statement of the hazard. Use of this phrase would obviate the need for a statement of the consequences. Most consumers understand the meaning of electrocution and do not need to have consequences stated in another form.

Finally, the most important statement needed in this instance is a means for avoiding the hazard. One suggested phrasing is "Turn off power to switches and outlets that could be contacted by tape". This would only be effective if the consumer were positive that all circuits behind the wall had been de-energized. However, this could be difficult to accomplish effectively because the consumer would need to have knowledge of the wiring pathways in the immediate area. In general, that is not a realistic expectation.

Human Factors therefore believes that while an improved label meeting the provisions of the ANSI Z 535.4 standard could marginally improve a consumer's awareness of the hazard, it would not eliminate the potential for electrocution. Instead, Human Factors points out that in situations where there is a potentially lethal hazard and the consumer cannot take reasonable steps to eliminate the hazard, alternatives other than labeling should be considered.