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United States
CONSUMER PRODUCT SAFETY COMMISSION
Washington, D.C. 20207

May 25, 1999

TO: Margaret L. Neily, Project Manager, Children's Sleepwear
Directorate of Engineering Sciences

Through: David A. Walden, Acting Associate Executive Director, DAW
Directorate of Laboratory Sciences
Robert T. Garrett, Director, Division of Engineering RTG

FROM: Linda Fansler, Division of Engineering LF

SUBJECT: Review of Foreign Flammability Standards for Children's Sleepwear

Three foreign children's sleepwear standards were reviewed in 1992 and another in 1994 as part of the Children's Sleepwear Amendment Project.[1,2] The standards were promulgated by Australia, Canada, New Zealand and the United Kingdom. They all include both fabric flammability and garment design requirements in their standards.[3,4,5,6]

Since the 1992 and 1994 reviews there have been some changes to the Australian regulations and the Canadian children's sleepwear enforcement guidelines. The children's sleepwear standards in the United States were also recently amended[7] to incorporate the element of garment design along with fabric flammability as the approach to reduce burn injuries to children from sleepwear garments.

This memorandum provides a brief description of each foreign standard and identifies any significant changes that have taken place. A brief discussion of the U.S. standard is also presented.

[1] Superscript refers to references on page 7.

AUSTRALIA

In 1972 the Standards Association of Australia issued AS 1249, *Safe Design Rules for Children's Night-Clothes*. AS 1249 - 1972 specified requirements for classifying and labeling children's sleepwear as to their perceived fire hazard. This standard covered sizes 12 months to 14 years of age. AS 1249 was revised in 1976 and in 1983 when the name of the standard was changed to *Children's Nightclothes Having Reduced Fire Hazard*. In 1990 further revisions were made including a change in the method to determine the burning behavior of the test specimen and specifying coverage in terms of a sizing range of 0 to 14 instead of an age range.

AS 1249 - 1990 categorizes garments as to their perceived fire hazard. Garments are divided into three categories, 1. 'Low fire danger', 2. 'Styled to reduce fire danger', 3. Warning high fire danger keep away from fire'. To qualify for the first category a garment must have a flame spread time of 12 seconds or more - 10 seconds or more for napped fabrics, and conform to restrictions on trim that can be added.

To qualify for the second category a garment must have a flame spread time of 10 seconds or more and conform to style and design requirements. Garments must be form fitting and meet restrictions for trim and fastenings. The standard limits the top of a two-piece garment in length and limits the width of the hemline, sleeves and pants legs. A garment that does not qualify for the first two categories is classified in the third.

In addition, if the garment contains 50% or more of a cellulosic, acetate or acrylic fiber content there are further restrictions on mass and garment length. AS 1249-1990 also requires sleepwear garments to be labeled as to their fire hazard category and includes requirements for cleaning sleepwear garments.

In 1999, AS 1249 - 1990 and a New Zealand standard, (see discussion of this standard in the section on New Zealand), NZS 8705:1989 were jointly revised[5] and designated as AS/NZS 1249:1999, *Children's Nightwear and Limited Daywear Having Reduced Fire Hazard*. Not yet published, AS/NZS 1249:1999 is known to the Commission staff only through its abstract.[6] The abstract however, provides information that AS/NZS 1249:1999 specifies requirements for fabrics, trims and labeling of children's nightwear and some daywear garments which are commonly worn both day and night, in sizes 00 to 14 in four categories.

CANADA

The flammability of children's sleepwear up to size 6X has been regulated in Canada under the *Hazardous Products Act* (HPA) since 1971. Those garments that do not comply cannot be sold, advertised or imported. The *HPA* specified that sleepwear garments be tested to the *Standard Method of Test for Flammability of Clothing*

Textiles, (ASTM D1230). This ASTM standard uses essentially the same test method as is found in the U.S. *Standard for the Flammability of Clothing Textiles*, 16 CFR Part 1610.

Despite of those early regulations, burn injuries and deaths persisted.[9] To address this problem, Canada amended the *HPA* and adopted more stringent regulations governing children's sleepwear. In 1987, the *Hazardous Products (Children's Sleepwear) Regulations* were issued. These regulations addressed loose-fitting sleepwear such as nightgowns, nightshirts, bathrobes, pajamas, etc., in sizes up to 14X. This category of children's sleepwear must comply with stringent flame resistance requirements based on 16 CFR Part 1616 of the U.S. code. Since then, loose-fitting sleepwear has been required to be made with fabrics that self-extinguish.

Polo pajamas, sleepers and sleepwear designed for hospital use or for infants weighing up to 7 kg (items designed for infants up to an age of about 6 months)[10] are exempt from the *Hazardous Products (Children's Sleepwear) Regulations*. These garments are exempt because Canada considers them to be "tight-fitting children's sleepwear" and as such are "less likely to make contact with ignition sources".[9] These garments are still subject to the provisions in the *HPA* and are required to be tested for flammability using the test method in ASTM D1230 with a time of flame spread of 7 seconds or less rather than being required to self-extinguish.

Garment dimensional restrictions were not specified in the *HPA* for these exempted garments. However, dimensional restrictions but were addressed when the 1987 *Enforcement Policy Guidelines* were issued.

In 1998 the guide was updated and is now known as the *Children's Sleepwear Flammability Requirement Guidelines, Policy Guidelines For The Children's Sleepwear Requirements Under the Hazardous Products Act*. The guide describes and illustrates each type of garment.

The updated guide has new illustrations and clarifies several sleepwear-related garments. It also lists changes to sleepwear dimensions, design restrictions for polo pajamas and sleepers, and dimensional criteria for the length of beach robes.

Maximum dimensional criteria is now given in smaller size ranges for the chest, seat, thigh, ankle, wrist locations and for polo pajamas, the length of shirt. New design restrictions include, requiring tight cuffs at the ends of sleeves and pants, banning lettuce edging and not allowing shirt tail hems. These and other design restrictions enhance safety by eliminating loose edges that can make contact with an ignition source.

NEW ZEALAND

The *Safety of Children's Night Clothes Act* was enacted in 1979, and became effective in 1980. This regulation required that all commercially manufactured nightwear for children 1 to 14 years of age to be made from fabrics defined as "low fire risk" or to be of a safer style, i.e., closer fitting pajama style. In 1987, this act was replaced by *The Fair Trading Act (Children's Night Clothes Product Safety Standards) Regulations 1987.* The 1987 regulations were revoked in 1990 and replaced with *The Children's Night Clothes (Product Safety Standard) Regulations 1990.*

The 1990 regulations cover all garments suitable for sleepwear for children age 6 months to 14 years and prescribe new product safety standards for children's night clothes. These regulations reference NZS 8705:1989, *Children's Night Clothes Having Low Fire Danger,* which sets out requirements for sleepwear garments of low fire risk. These low fire risk garments are made from fabrics meeting NZS 8704:1989, *Low Fire Danger Fabrics For Domestic Apparel.* Fabrics that comply with this standard do not ignite easily and burn slowly, because of their fiber content, weight and other factors. The trim used on low fire risk garments must also comply with NZS 8705:1989. There are no style restrictions for these garments.

Garments not made from "low fire danger fabric" must meet garment design and fabric flammability restrictions. These garments may be made from any fabric except those which surface burn rapidly, and must be designed to reduce fire risk, i.e., they must be tighter fitting. Labeling is also required by the New Zealand sleepwear regulations informing consumers of the potential fire hazard and the appropriate method of cleaning.

Although the discussion of the Australian children's sleepwear standard states that there will be a joint Australian/New Zealand standard (AS/NZS 1249:1999), no reference to this joint standard evaluation was found under New Zealand standards.

UNITED KINGDOM

Regulations governing the flammability of children's sleepwear have been in effect in the United Kingdom since 1964 with the enactment of the *Children's Nightdresses Regulations 1964.* In 1967 this regulation was revoked and *The Nightdresses (Safety) Regulations 1967* was enacted. The current regulations regarding the performance requirements for children's sleepwear are governed by the *Nightwear (Safety) Regulations 1985*, amended in 1987. This regulation covers children's nightdresses, dressing gowns and other similar garments for children over 3 months and under 13 years of age.

These types of "looser fitting" garments must comply with flammability requirements specified in the British Standard, BS 5722, *Flammability Performance of Fabrics and Fabric Assemblies Used in Sleepwear and Dressing Gowns.* BS 5722 specifies a rate of flame spread. The fabrics and garments meeting this standard are intended to give

protection against rapid flame spread rising from accidental contact with small ignition sources.

The flame spread rate is measured using the British Standard, BS 5438, *British Standard Methods of Test for Flammability of Textile fabrics When Subjected to a Small Igniting Flame Applied to the Face or Bottom Edge of Vertically Oriented Specimens.* This test method was designed to ensure that all sleepwear fabrics which burn completely fail to comply with the test. The test method requires that after being subjected to a small butane flame for 10 seconds, the fabric test specimen does not burn a distance of 12 inches in less than 25 seconds and a distance of 24 inches in less than 50 seconds.

BS 5438 references British publication, PD 2777, *Fabric Flammability and Burning Accidents.* PD 2777 provides background information on the flammability of textile materials and their involvement in burning accidents. PD 2777 also discusses the importance of garment design and fire safety, noting that the safe design of children's sleepwear garments is part of the Australian legislation.

Maximum dimensional restrictions are given in the *Nightwear (Safety) Regulations* and include the chest, and garment length measurements for nightdresses and the chest and sleeve measurements for dressing gowns, bath robes and other similar garments. Other garments such as pajamas and adult nightwear do not have to comply with the flammability standards but must be labeled indicating whether they meet the flammability standard. The United Kingdom regulation includes specific labeling requirements.

UNITED STATES

The United States has regulated the flammability of children's sleepwear since 1972, when 16 CFR Part 1515, the *Standard for the Flammability of Children's Sleepwear: Sizes 0 Through 6X* became effective. A similar standard, governing sleepwear in sizes 7 through 14, was added in 1975 (16 CFR Part 1616). These flammability standards require that children's sleepwear be flame resistant; the fabrics must self-extinguish after exposure to a small flame. The intent of these standards is to protect children from suffering thermal burn injuries due to clothing ignition when wearing sleepwear for normal activities.

In 1996, the children's sleepwear standards were amended to exempt sleepwear for children 9 months or younger and tight-fitting garments, defined as garments up to size 14 that do not exceed certain measurements for the chest, waist, seat, upper arm, thigh, wrist, and ankle. Those sleepwear garments exempt from 16 CFR Part 1615 or

1616 are subject to 16 CFR Part 1610, the *Standard for the Flammability of Clothing Textiles.* Less stringent than the children's sleepwear standard, Part 1610 prohibits the

use of fabrics considered to be dangerously flammable.

DISCUSSION/CONCLUSION

Regulations concerning the flammability of children's sleepwear for the U.S. and four other countries are difficult to compare since as each regulation has many inter-related factors. These factors include the method of flammability testing, labeling required and the sizing dimensions required. The methods of flammability testing vary including criteria specified, flame size and type, specimens size and number, ignition location and flame application time. Mandatory labeling regarding fit and flammability also varies for those countries requiring labeling. Maximum dimensional sizing for those countries where dimensions are specified are all less tight than those specified in the U.S. regulations. All of the factors including burn and injury data need to be evaluated before a judgement is made regarding effectiveness.

Since the last reviews, both Australia and Canada have made changes to either their regulations or the guidance given concerning the regulations. The changes were made to expand coverage or to clarify sizing and design restrictions.

Australia is currently expanding coverage of their flammability standard to include some children's daywear garments that are commonly worn both day and night. Canada has not made any recent changes[10] to the children's sleepwear requirements but in 1998 updated the *Children's Sleepwear Flammability Requirement Guidelines.* These changes include design restrictions to eliminate loose edges and gradient sizing to the criteria used to determine snug-fitting children's sleepwear.

REFERENCES

1. Briefing Package, Sleepwear Evaluation Project, Terrance R. Karels, Project Manager, November 3, 1992.

2. Briefing Package, Children's Sleepwear Project, Terrance R. Karels, Project Manager, July 19, 1994.

3. Australian Standard, *Children's Nightwear and Limited Daywear Having Reduced Fire Hazard*, AS/NZ 1249;1999, Standards Australia.

4. *Hazardous Products Act, Hazardous Products (Children's Sleepwear) Regulations*, 1987, Consumer and Corporate Affairs Canada.

5. *The Children's Night Clothes (Product Standard) Regulations 1990*, New Zealand Government.

6. The Nightwear (Safety) Regulations, amended 1987, Department of Trade and Industry, United Kingdom.

7. Federal Register, Volume 61, No. 175, Monday, September 9, 1996, Rules and Regulations, Consumer Product Safety Commission, 16 CFR Parts 1615 and 16165, Flammable Fabrics Act: Children's Sleepwear (Sizes 0-6x, 7-14) Flammability Standards; Final Rule.

8. Standards Australia web site, www. standards.com.au/catalogue.

9. Children's Sleepwear: Flammability Requirement Guidelines, Policy Guidelines For The Children's Sleepwear Requirements Under The Hazardous Products Act, August 1998, Health Canada.

10. Log of Telephone Conversation, between Linda Fansler, LS, CPSC and Ms. Christine Simpson, Health Canada, Product Safety Bureau, March 31, 1999.

LOG OF TELEPHONE CALL
Directorate for Laboratory Sciences

Log Entry Source: Linda Fansler, LSE LF

Contact: Ms. Christine Simpson, Health Canada, Product Safety Bureau (905-572-2845)

Date of Conversation: March 31, 1999

Ms. Simpson was called to ask the status of the children's sleepwear standards in Canada. Ms. Simpson stated that there has been no recent change to the children's sleepwear requirements under the *Hazardous Products Act* since 1987. What has changed is the *Children's Sleepwear Flammability Requirement Guidelines*. These are guidelines to aid manufacturers and importers of children's sleepwear in identifying sleepwear. The changes to this guideline include the incorporation of policy rulings so that all manufacturers are aware of previous policy interpretations. Also changed was the previous policy of a limited dimensional sizing restriction. Previously, two levels of sizing were given 0 to 6X and 7 to 14, for "lower risk" garments. The *Guidelines* now have a gradient sizing and dimension interpretation, so dimensions are stated for each individual size. Ms. Simpson agreed to send me a copy of the new *Children's Sleepwear Flammability Requirement Guidelines*, dated 1998.

Ms. Simpson was also asked about any recent research or testing concerning sleepwear garment fit or flammability. Ms. Simpson stated that Canada does not have the time or money to do research and Health Canada relies on a complaint system or injury data to update their standards. Ms. Simpson stated that there "has not been any deaths since 1987 and that injuries are down".

Ms. Simpson noted that alternatives such as T-shirts are used as sleepwear in the United States, but are not an issue in Canada due to the weather and the availability of cotton "polo-style pajamas".

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May 28, 1999

TO: Margaret L. Neily, Project Manager, Children's Sleepwear
Directorate of Engineering Sciences

Through: David A. Walden, Acting Associate Executive Director, DAW
Directorate of Laboratory Sciences RTG
Robert T. Garrett, Director, Division of Engineering

FROM: Linda Fansler, Division of Engineering LF

SUBJECT: Response to Comments Received as a Result of Publishing the Children's Sleepwear Revocation Proposal, and the Public Hearing on the Proposed Revocation

This memorandum responds to comments concerning the proposal to revoke the 1996 amendments to the children's sleepwear standards. The comments were received either as a response to the Federal Register notice, or written and oral testimony presented at the Public Hearing on the proposed revocation. These amendments concern the exemption of infant and tight-fitting sleepwear from the requirements of the standards.

1. Flame retardant chemicals added to complying sleepwear

Comment: Children do not need to be exposed to the flame retardant chemicals previously used on cotton sleepwear to make it comply with the children's sleepwear standards. (H. Obenshain, parent, CF99-1-2)

Response: The commenter is correct, until the amendments exempting tight-fitting sleepwear and sleepwear for children 9 months or younger went into effect, sleepwear garments made from 100% cotton had to be treated with flame retardant chemicals to comply with the children's sleepwear standards.

2. House Fires/Bedding Fires

Comment: "It is a sad fact that children, infants and toddlers do die because of house fires. But the fact is most deaths are caused by smoke inhalation ... things in the crib are not flame retardant, I see no reason to make his sleepwear that way." (H. Obenshain, parent, CF99-1-2)

Comment: "The standard was never applied to sheets or bed covers so that if ... drop a cigarette or a match in a crib, the sheets and covers would catch fire long before there was a chance for the clothing to burn." (L. Schwab, Little Me, CF99-1-7)

Comment: "... a 9 year old boy who was burned when his bedroom caught fire. He ... dropped, ... crawled ... out to safety. Unfortunately the loose, baggy pants he was wearing for sleeping caught fire from some flying cinders and ignited." (D. Reilly, MD, University of Southern California, CF99-1-24)

Comment: "By relaxing these standards ... CPSC has endangered the lives of all young children unfortunate enough to be involved in a fire." (D. Sommers, grandparent, CF99-1-96)

Comment: "... children are more likely to suffer from smoke inhalation that could occur from wearing loose clothing than by an actual fire. However, if a child is trying to escape fire and is struck by a flame ... likely to escape severe or fatal injury by wearing flame resistant sleepwear. ... reinstate stricter standards on children's sleepwear could not be better supported than by ... an immobile infant at the time he received severe burns in a house fire." (G. Fitzgerald, parent, CF99-1-99)

Comment: "The rare or exceptional accidents for infants lying in their cribs, still occur. However, complying fire resistant garments also provide no protection from injury under these ... circumstances. In fact, they provide less protection than untreated cotton garments. If the bedding or crib or the house burns, or if something burning is tossed on the bed and over the child, none of the products on the market, fire resistant or not under 16 CFR 1615 and 1616, will provide protection from injury." (P. Wakelyn, National Cotton Council of America, CF99-1-130)

Comment: "As a burn survivor... . I was burned at the age of six weeks, and I certainly wasn't playing with matches. The house fire that almost took my life caused ... second and third degree burns... . I was wearing a cotton sleeper. Had flame resistant material been the standard in 1954, my injuries would have been less severe." Mr. Borowski stated in his oral testimony it was not a house fire but a bassinet fire. (D. Borowski, burn victim, CF99-1-145 and oral testimony, April 22, 1999)

Comment: The commenter discussed two examples of children burned in crib fires and showed slides of the resulting burn injuries to these children. (D. Herdon, MD, American Burn Association, oral testimony, April 22, 1999)

Response: The children's sleepwear standards were not intended to address the risk of death and injury from exposure to a whole house or bedding fire. The intent of the sleepwear standards is to eliminate the risk of serious personal injury or death from fire as a result of contact between the sleepwear garment and a small ignition source such as a match or lighter flame. The test method reproduces this fire scenario with a three second exposure to a moderate sized flame; and the standard requires the fabric to self-extinguish.

Scenarios involving a whole house or bedding fire are quite different from a fire science perspective. The garment is not the first item ignited, therefore, the ignition source in these fire scenarios is larger and more intense and sustained well beyond three seconds. Standard test methods exist that use larger, appropriate ignition sources to reproduce fire scenarios involving sheets of burning newspaper, small trash can fires, and burning rooms. The heat released and temperatures produced in the larger fire scenarios can easily exceed the temperatures produced by the small open flame sources.[1,2]

Even flame resistant polyester cannot be expected to provide reliable protection from serious burn injury in these larger fires. Polyester fibers generally begin to melt between 480 and 570°F. These temperatures alone are enough to burn human skin. Polyester generally ignites and burns at temperatures exceeding 840 and 1290°F respectively. Cotton, while it does not melt, typically ignites and burns at temperatures in the range of 490 to 1560°F.[3] Human burns occur when the skin temperature exceeds approximately 110°F[4] which may explain how a child can, under particular circumstances, be burned on exposed skin and "protected" in areas covered by sleepwear or other garments, flame resistant or not.

Because of their melting and ignition temperatures and the high temperatures and sustained fire growth that occurs in these larger fire scenarios, and the many other factors affecting the outcome of an incident, flame resistant sleepwear garments cannot always be counted on to provide enough protection to prevent life-threatening burn injury from occurring. Only protective clothing that resists burning, melting or disintegration on exposure to heat or flame such as the heat-protective clothing worn by firefighters would reliably provide the level of protection needed in whole house or bedding fire scenarios described by commenters. Also, the primary cause of death in house fires is smoke inhalation, a factor not influenced by flame resistant garments, rather than burn injury.

[1]Superscript refers to references on page 12.

Comment: "The snug-fitting sleepwear concept was developed ... and was rigidly examined by CPSC for safety in all foreseeable fire scenarios." (R. Verdisco, International Mass Retail Association, CF99-1-127)

Response: CPSC staff reviewed[5] available literature discussing the concept of tight-fitting and fire safety. However, even with the amendment in place, it is still the intent of the children's sleepwear to protect children from suffering serious thermal burn injuries due to clothing ignition from a small flame ignition source, when wearing sleepwear for normal activities, not to safeguard them in all foreseeable fire scenarios.

3. Importance of fit

Comment: "The combination of non-flame resistant material and large, baggy clothing can be lethal." (D. Herndon, MD, Shriners Burns Hospital, CF99-1-8) and Members of Congress (48), Congress of the United States, CF99-1-31)

Comment: "Tight fitting sleepwear is less likely to come in contact with an ignition source, the garment must be nearly skin tight and tight at the wrist, ankles, and other key points for it to be a 'safer choice'. ... It is also questionable whether tight fit compensates for the increased dangers associated with more flammable materials such as cotton." (L. Solem, MD, Regions Hospital, CF99-1-16)

Comment: "While tight-fitting sleepwear is less likely to come in contact with a flame or other ignition source, the garment must be nearly skintight for it to be a 'safer choice'." (D. Motz, RN, Burn Trauma Unit, St. Luke's Regional Medical Center, CF99-1-17)

Comment: "Moreover, because the pajamas are either snug-fitting or used for infants ... they are not about to catch on fire." (C. Palmer, parent, CF99-1-35)

Comment: "... the left sleeve of my tight-fitting thermal underwear ... caught on fire. Within a second, the fire that started near my wrist spread up to my shoulders. ... I ... only suffered singed hair on my arm." (H. Kim, International Association of Fire Chiefs, written and oral testimony, April 22, 1999)

Response: Garment fit, along with fiber content can influence a garment's flammability. Children's sleepwear made from cotton fabric needs to fit tight, close to the body, to provide an acceptable level of risk. There is a great deal of information in the literature discussing the concept of tight-fitting garments being less hazardous than loose-fitting garments. The ease of ignition increases when the wearer's clothing stands away from the body and the excess fabric functions as a connector to the ignition source. Without a tight fit, if ignition occurs, the oxygen under the garment and the absence of a heat sink (the body), increases the opportunity for sustained burning. Research indicates that relatively safe sleepwear garments can be made from cotton

fabric whose combustion characteristics do not meet the flammability requirements of the children's sleepwear standards, i.e. they do not self-extinguish.[5] Comfortable, practical, tight-fitting sleepwear can and is being produced that is acceptable to consumers.[6]

Comment: "... she lit one of the matches. When the flame startled her, she dropped the match and it landed on her nightgown. In seconds, Maria had sustained third degree burns over 38% of her body." (R. Stilwell, parent, CF99-1-66, written and oral testimony, April 22, 1999)

Comment: "On June 24th, 1972, at three years of age, ... wearing a nightgown that was made while there was not a sleepwear standard in effect. ... picked up a box of matches and lit one. My nightgown caught on fire and because it was not flame retardant, the fire instantly melted the fabric to my skin." (Maria Leightley, burn victim, CF99-1-131)

Response: What happened to Maria was exactly what Congress intended to prevent when it amended The Flammable Fabrics Act in 1967 to provide the authority to issue new, more stringent flammability standards. This led to the issuance of the children's sleepwear standards. The 1996 amendments to the children's sleepwear standards exempt only tight-fitting sleepwear garments for children. Cotton nightgowns like the one Maria was wearing, do not meet the definition of tight-fitting. The importance of tight-fitting is stated above.

4. Fire Safety

Comment: "...to alert ... about the dangers of cotton sleepwear, ... fire department demonstrated the difference in ignition of cotton vs flame resistant sleepwear. ... demonstration was unbelievable. The cotton sleepwear flamed up and burned very quickly. This would most likely result in severe facial and upper body injuries. The flame resistant sleepwear took longer to ignite, ... once the ignition source was removed, the fabric quit burning and extinguished itself." (D. Motz, RN, Burn Trauma Unit, St. Luke's Regional Medical Center, CF99-1-17)

Response: It is not surprising that the commenter observed that the cotton sleepwear "flamed up and burned very quickly". Light weight, cellulosic fibers usually ignite readily when in contact with an ignition source, burn steadily and their flames are often difficult to extinguish. Flame resistant fabrics made from thermoplastic fibers are not as easily ignited and have a tendency to shrink away from the heat source. During ignition, the fibers may melt and shrink. If the flame is carried with the melt-drip, the fabric may self-extinguish.[5]

The fire department demonstration did not take into account garment fit and the presence of a heat sink, major factors influencing a garment's flammability. The garments were burned on hangers and as stated above, a tight fit reduces the possibility of ignition occurring. If ignition of tight-fitting clothing occurs, flame spread is slower and less intense, allowing the wearer to take action sooner. Because tight-fitting clothing is less likely to support flame propagation, it is often easier to extinguish the flames.[5]

Comment: "... there's a flash fire from ... jet fuel, natural fibers just burn to ash while synthetic fibers melt onto your skin where they continue to cause heat damage, and if on fire, burn like napalm for a long time. It is not clear that polyester pajamas are "better" because they don't 'burn'. They melt and that might be worse, depending on the situation." (D. Gregg, consumer, CF99-1-25)

Comment: Children's sleepwear that is flame resistant offers protection to the portions of a child's body covered by the sleepwear and areas of the body not covered, but exposed to the flame, are severely burned. (G.P. Kealey, MD, The University of Iowa Hospitals and Clinics, CF99-1-19 and D. Herndon, MD, The American Burn Association, oral testimony, April 22, 1999)

Comment: "... these injuries occurred ... when a halogen lamp fell into the infant's crib. Had this child been in flame-resistant sleepwear, there is every probability that the injuries would have been less severe. ... Can I say with scientific certainty that these cases could have been avoided had the child been clothed in flammable-resistant sleepwear? ... can say with certainty that the old, more stringent standard was remarkably effective in reducing these types of sleepwear-related injuries." (D. Herndon, MD, Shriners Hospitals for Children, written testimony, April 22, 1999)

Comment: Cotton sleepwear may be slightly more protective than flame resistant garments in a crib or house fire. (P. Wakelyn, National Cotton Council of America, written testimony, April 22, 1999)

Response: The fire scenarios described above are not addressed by the children's sleepwear standards. It is not possible to conclude that a garment passing a three second flame test as required by the sleepwear flammability standard will provide protection in a larger fire. A number of variables contribute to the outcome of burn injury such as the circumstances surrounding the accident, the victims reaction/activity, the fabric characteristics (weight, weave, finishes/treatments applied, fiber content, dyes, etc.), size of the flame and location on the garment where the flame comes into contact with the garment, flame propagation, rate of heat transfer, presence of undergarments, etc. Much of this data cannot be obtained through investigations.

Comment: "Any change in that original standard increases the risk that a firefighter or a child will be injured as a result of a fire instigated by a sleepwear incident." (F. Allinson, National Volunteer Fire Council, CF99-1-4)

Comment: "... since non-flame resistant sleepwear is more likely to catch on fire, it is more likely to ignite a fire that will spread throughout the house, causing injury to family or firefighters." (R. Blumenthal, Attorney General of Connecticut, [and attorney generals from 13 other states], CF99-1-113)

Response: The staff does not believe that the 1996 amendments will result in more fire incidents involving cottong garments. There is no evidence to show that if tight-fitting, non-flame resistant sleepwear ignites it is more likely to ignite a larger fire than polyester sleepwear.

5. Snug-Fitting Cotton, A Safe or Unproven Alternative?

Comment: Support the amendment allowing sale of tight-fitting untreated cotton products as complying sleepwear. This amendment offers a safe sleepwear alternative. (M. Grant, parent, CF99-1-39, T. Fisher, parent, CF99-1-101, B. Adamson, H. Isbell, Alabama Farmers Federation, CF99-1-103, S. Lamar, American Apparel Manufacturers Association, CF99-1-114, D. Sargent, American Marketing Enterprises Inc., CF99-1-126, R. Verdisco, International, Mass Retail Association, CF99-1-127, and P. Clark, consumer, CF99-1-134)

Comment: "... maintain the amendment allowing the sale of snug-fitting, untreated cotton products as complying sleepwear. They pose no safety hazard to children." (E. Weaver, consumer, CF99-1-88)

Comment: "I understand the CPSC made these changes in 1996 based on extensive research and hearings. The research concluded these changes provided parents with a safe alternative with presenting a risk to children." (H. Bonilla, Member of Congress, CF99-1-138)

Comment: "After 5 years of exhaustive research and extensive hearings, the CPSC concluded that snug-fitting cotton products do not present a flammability risk to children." (E. Lucus, National Cotton Women's Committee, CF99-1-143)

Comment: "... providing an unproven and speculative "tight fitting" untreated cotton alternative." (A. O'Neil, National Fire Protection Association, CF99-1-104)

Comment: The industry has presented no evidence/studies showing that the tight-fitting requirements would deliver safety comparable to the requirements of the original sleepwear requirements and that the safety benefits of tight-fitting garments outweigh

the dangers associated with more flammable materials. (A. O'Neill, National Fire Protection Association, CF99-1-104 and R. Blumenthal, Attorney General of Connecticut, [and attorney generals from 13 other states] CF99-1-113)

Comment: "Nor can we know for certain whether "tight-fitting" cotton pajamas are indeed less likely to burn. On the other hand, we do know that untreated cotton burns quickly, and some of the untreated cotton sleepwear sold today will not be tight-fitting. The CPSC should not encourage the use of this flammable material in children's sleepwear. The standard in force from 1972 to 1996 was far more secure." (R. Andrews, U.S. House of Representatives, CF99-1-123)

Comment: "For the new standard, the logic was that children would sleep in garments manufactured for age-appropriate tight fit. No data was provided on how tight a fit was necessary to achieve burn protection." (J. Hall, National Fire Protection Association, written and oral testimony, April 22, 1999)

Response: Burn injuries can be reduced by requiring that sleepwear be tight-fitting when using non-flame resistant fabrics such as cotton. Commission staff has reviewed data[5] which indicated that close fitting garments can be less hazardous even when made from a potentially flammable fabric. Studies have been conducted to examine the thermal injury data from clothing burns and the burning behavior of garments and fabrics in the laboratory. This same research also shows that the degree of fit is very important.[5] For this reason, the amendments clearly define tight-fitting. Tight-fitting children's sleepwear must meet very specific criteria to comply with the amendments.

This philosophy of relying on tight-fitting garments to provide an acceptable level of safey is not new or novel. Governments around the world that have flammability requirements for sleepwear rely on this same principle in their regulations.[6]

6. Requirements of the children's sleepwear standards

Comment: The amendments allowing sale of untreated, tight-fitting cotton sleepwear do not relax safety considerations. These products still have to pass the general wearing apparel standard. Also, loose-fitting sleepwear products are still required to pass a severe flame test. This amendment offers the consumer safer sleepwear alternatives. (S. Francis, parent, CF99-1-33, B. Adamson, H. Isbell, Alabama Farmers Federation, CF99-1-103, S. Long, Southern Rolling Plains Cotton Growers Association, Inc., CF99-1-118, and P. Clark, consumer, CF99-1-134)

Comment: "Contrary to the misleading information conveyed by some, these amendments did not affect loose pajamas, nightgowns, and robes, which are the kind of nightwear involved in burn injuries and fatalities. Those items still must meet the requirements of the Children's Sleepwear Flammability Standards and be fire resistant. In addition, tight-fitting garments must comply with the Standard for the Flammability of Clothing Textiles, 16 CFR 1610." (P. Wakelyn, National Cotton Council of America, CF99-1-130)

Comment: "The sale of untreated cotton sleepwear does not relax safety standards and these garments will still have to pass flame testing." (M. Morrison, Grown & Made in the USA, CF99-1-139)

Comment: "Support the amendment because it meet (safety guidelines) and (structure requirements)." (S. Newell, consumer, CF99-1-140)

Comment: "The CPSC already has in place stringent safety requirements and tests that go above and beyond that what is needed to ensure the general public that cotton garments do not pose an unreasonable health risk." (J. Hardwick, Louisiana Cotton Producers Association, CF99-1-142)

Response: Tight-fitting sleepwear garments as well as sleepwear garments intended for infants are exempted by the amendments to the flammability requirements of the children's sleepwear standards, but are subject to the requirements of the Standard for the Flammability of Clothing Textiles, (16, CFR part 1610). The flammability requirements for the Standard for the Flammability of Children's Sleepwear: Sizes 0 through 6x (16, CFR Part 1615) and Sizes 7 through 14 (16, CFR Part 1616) are however, more stringent.

Comment: "IMRA firmly supports the amendments' goal of offering consumers a safe alternative to flame-resistant sleepwear made of fabric that many parents regard an uncomfortably heavy. ... Until 1997, ... required that garments marketed or sold as children's sleepwear pass flammability tests more rigid than those mandated for general wearing apparel. Since only heavy fabrics (e.g., polyester or wool) were able consistently to meet that standard, consumer choice ... limited to heavy garments... ." (R. Verdisco, International Mass Retail Association, CF99-1-127)

Response: The children's sleepwear standards do not specify certain fabrics, fabric weights or require flame retardant treatments. Garments subject to the flammability test procedure in the children's sleepwear standards must be made from fabrics that self-extinguish when exposed to a small open flame. Fabrics known to meet these requirements include modacrylic and some polyesters. Currently, polyester fabric in light and medium weights is widely used to manufacture loose-fitting children's sleepwear.

7. Production Issues

Expansion of snug-fitting dimensions

Comment: "IMRA urges CPSC to increase slightly the dimensions that define a snug-fitting garment exempt from children's sleepwear flammability rules. ... The snug-fitting exemption is intended to offer parents a safe cotton sleepwear alternative and deter the use of more flammable garments as sleepwear. Parents seeking to dress their children in cotton garments may not accept snug-fitting sleepwear because they view the fit as too tight. ... Slightly increasing the snug-fitting dimensions may make the garments more attractive to parents currently avoiding snug-fitting sleepwear without compromising the garment's safety. A slightly larger garment is far safer than an oversized T-shirt." (R. Verdisco, International Mass Retail Association, CF99-1-127)

Response: Commission staff carefully considered the option to allow a less than tight fit for exempted children's sleepwear during the Rulemaking Process in amending the sleepwear standards. The reduced probability of ignition of tighter fitting clothing is related to three factors: the limited supply of oxygen from underneath the garment, the role that the body plays as a heat sink, and reduced likelihood of contacting the flame source. However, while a tighter fitting garment can reduce the possibility of the garment coming in contact with a source of ignition, a review of the literature did not reveal a specific safe level or range of fit. Commission staff concluded that for tight-fitting garments to be exempt from the children's sleepwear standards, the garment must touch the body at all critical locations.[5] To do this, children's sleepwear garments must be equal to or less than the body dimension at these locations. Commission staff is aware that comfortable tight-fitting sleepwear garments are currently being manufactured.[6]

Sewing tolerances

Comment: "To allow for mass-production variances and sewing errors, CPSC should create a narrow sewing tolerance for all parts of a snug-fitting garment. While not significantly increasing the size of the garment, such a tolerance would provide sleepwear makers and retailers with a workable margin of error. IMRA urges CPSC to allow ... a half-inch tolerance for a snug-fitting garment's chest, waist, seat and thigh and a quarter-inch tolerance in a snug-fitting garment's upper arm, wrist and ankle dimensions. These tolerances would allow a better fit, while only minimally increasing the size of the garment. ... providing sewing tolerances is a long-recognized practice in the apparel industry... ." (R. Verdisco, International Mass Retail Association, CF99-1-127)

Response: Commission staff recognizes that tolerances are normally used in the production of all garments and allow for permissible variations to the pattern specifications that can occur during cutting or sewing of the garment. However the addition of a production tolerance which would increase the garment dimensions from those specified in the amended children's sleepwear standards, would result in a less than tight-fitting sleepwear garment.[8] The importance of a tight-fit has been stated above.

The garment dimensions specified in the standards are maximum dimensions for the seven body locations indicated. Manufacturers are allowed to sell tight-fitting sleepwear garments as long as the garment dimensions for a specific size are not exceeded. Knit fabrics are available with a sufficient degree of stretch that even if the manufacturer undercuts the fabric somewhat, the garment would still fit the intended size child.[6]

CPSC staff are aware of children's sleepwear garments manufactured to the dimensions specified in the sleepwear standards, that are currently being sold to consumers.[6] Manufacturers are able to produce acceptable sleepwear garments through the selective use of specific knit fabrics that allow for the necessary stretching and recovery and result in a garment that hugs the body, and through careful planning before and during the manufacturing process to build in acceptable tolerances to the pattern so that the finished garment after assembly will meet the required specifications.[8]

8. Canadian Children's Sleepwear Standards

Comment: "Canada originally adopted the US children's sleepwear flammability standards but modified them in 1987. The major reasons for amending their standard were results from mannequin testing of garments ... and a Canadian Medical Association paper... ." (P. Wakelyn, National Cotton Council of America, CF99-1-130)

Response: Regulations regarding the flammability of children's sleepwear have been in place in Canada since 1971. These regulations, found in the Hazardous Products Act, set minimum requirements for children's sleepwear. Canada has required, since 1987, children's sleepwear up through size 14X to meet essentially the same regulations that sleepwear in the United States meets, except for tight-fitting garments such as "polo pajamas and sleepers". The exempted garments were required to continue to meet a flammability standard based on ASTM D1230[9] which has a test method essentially the same as the test method in the Standard for the Flammability of Clothing Textiles, 16 CFR Part 1610. However, Canada requires a more stringent acceptance of 7 seconds flame spread with no base ignition. This is more severe than the acceptance criteria of 1610 which is 3.5 or 4 seconds[a] with a base burn.[10,11]

[a] Class 3 fabrics have an average burn time of less than 3.5 seconds for plain surface fabrics and less than 4.0 seconds with two or more base burns. These fabrics are considered to be dangerously flammable and do not meet the acceptance criteria of 16 CFR Part 1610, Standard For The Flammability of Clothing Textiles.

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2. Babrauskas, V., Krasny, J., NBS Monograph 173, Fire Behavior of Upholstered Furniture, U.S. Department of Commerce, National Bureau of Standards, November 1985.

3. Cote, Arthur E., ed., Fire Protection Handbook, 17th Edition, 1991.

4. Stoll, Alice, Chaianta Maria A., *Heat Transfer Through Fabrics As Related To Thermal Injury*, Transactions New York Academy of Sciences, October 1970.

5. Memorandum to Terrance R. Karels, Project Manager Children's Sleepwear Project, ECPA, from Linda Fansler, ESME, "Technical Rational Supporting 'Tight Fitting' Children's Sleepwear Garments", March 14, 1994, CPSC.

6. Briefing Package, Children's Sleepwear Flammability Standards, Technical and Enforcement Policy Amendments, April 1998, CPSC.

7. Memorandum to Margaret L. Neily, Directorate for Engineering Sciences, Project Manager, Children's Sleepwear, from Linda Fansler, Division of Engineering, "Review of Foreign Flammability Standards for Children's Sleepwear", May 25, 1999, CPSC.

8. Memorandum to Margaret L. Neily, Directorate for Engineering Sciences, Project Manager, Children's Sleepwear, from Linda Fansler, Division of Engineering, "Production Tolerances For Snug-Fitting Children's Sleepwear", April 8, 1998, CPSC.

9. ASTM D1230-94, *Standard Test Method for Flammability of Apparel Textiles*, American Society For Testing And Materials, Vol. 07.01, 1997.

10. Hazardous Products Act, Hazardous Products (Children's Sleepwear) Regulations, July, 1987, Canada.

11. Memorandum to Terrance R. Karels, Project Manager, Children's Sleepwear, Directorate for Economic Analysis, from James F. Hoebel, "Canadian Children's Sleepwear Regulations, November 8, 1995, CPSC.

Tab I

United States
CONSUMER PRODUCT SAFETY COMMISSION
Washington, D.C. 20207

MEMORANDUM

DATE: June 2, 1999

TO : File

Through: Andrew Stadnik, AED for Engineering Sciences
Nicholas Marchica, Director, ESME

FROM : Margaret L. Neily, Project Manager
ESME

SUBJECT: Analysis of Public Comments on Proposed Revocation of the 1996 and Subsequent Amendments to the Children's Sleepwear Flammability Standards

This memorandum provides responses to comments on the January 19, 1999, proposed revocation of the 1996 amendments to the Children's Sleepwear Flammability Standards and other supporting information for the staff briefing package.

1. Responses to Comments on Burn injuries/data

Comment:
Burn centers, burn victims, and others shared information on various burn injury cases stating that the exemptions should be revoked to prevent an increase in burn injuries.

Response:
The CPSC staff investigated all cases possible within the time constraints of this proceeding. One hundred thirty-four cases involving thermal burns from children's clothing were referred to the staff by four Shriners burn hospitals: Galveston, Boston, Cincinnati, and Sacramento. Because of the time constraints imposed by the law, we focused on those cases most likely to be relevant to the issue of revoking the 1996 sleepwear exemptions. Thirty cases meeting the following criteria were requested for in-depth investigation.

1. **All** incidents involving children $\leq$1 year old
2. Incidents involving children <15 years old
3. No flammable liquid involvement
4. Ignition source is small or possibly uncertain (not house fire, mattress/bedding fire, explosion, campfire)
5. Garments are sleepwear, T-shirts (exclude those that are clearly daywear--shorts/shirt, jeans, dress)
6. Incident occurred in the U.S.

Most of the cases reported by the hospitals involved garments (daywear) or fire scenarios not addressed by the sleepwear standard such as house fires, gas explosions. The thirty cases meeting the criteria were requested for investigation. With permission from the hospitals and victims' families, 21 cases were assigned, expedited, and completed for the staff analysis. These in-depth investigations are included in those evaluated in the May 1999 Epidemiology report, "Sleepwear-Related Thermal Burns in Children under 15 Years Old". The CPSC in-depth investigations revealed that none of these cases involved garments exempted from the standard by the 1996 amendments or garments previously subject to the stay of enforcement.

Several commenters were burn victims or parents of burn victims. Two of the garments involved in these incidents were nightgowns. These garments must still be flame resistant under the 1996 amendments. The other case involved an infant wearing a cotton sleeper injured in a bedding fire, a scenario not addressed by the 3 second small flame exposure embodied in the test method of the standards.

One commenter supporting the revocation was a burn victim whose only injury was singed hair when his "tight-fitting" (by his description) thermal underwear ignited from a stove burner. This case and another previously mentioned in Tab C of the January 1999 briefing package (tight-fitting T-shirt) are examples of how the fit of a garment can minimize injury severity when exposed to a small ignition source.

2. Response to Comments on the Scope of the Standards and Exemptions

Comment:
A number of commenters believed that the Commission issued the 1996 amendments with the expectation that consumers would switch to tight-fitting sleepwear from loose-fitting T-shirts.

Response:
The 1996 amendments were intended to provide consumers who prefer natural fibers (cotton) with a safer alternative to the loose fitting, non-complying garments used frequently as sleepwear, such as long underwear. While the staff did not necessarily expect consumers using T-shirts to switch to the tight-fitting garments, they did anticipate that any such substitutions by consumers could reduce the number and severity of burn injuries should they occur. (October 11, 1995 Briefing Package on the Children's Sleepwear Project)

3. Further Evaluation of In-depth Investigations

The June 1999 report "Sleepwear-Related Thermal Burns in Children under 15 Years Old", at TAB F of this briefing package,

describes 3 in-depth investigations as potential in-scope cases. With follow-up questions answered by investigators and in consultation with Laboratory Science, Engineering and Compliance staff, these cases were determined to be outside the scope of the 1996 amendment issue.

Case #1:
This case is out of scope for two reasons. The garment worn by the child was clearly described by the mother as daywear, not sleepwear. Because it does not meet the definition of sleepwear in the Standard, the garment is not covered by the Standard. This incident also involved a house fire resulting in severe damage to the house; a fire scenario not addressed by the Standard.

Case #2:
The mother's description of the terry cloth sleepwear (100% cotton) was inconsistent with her description of the garment's behavior in the fire--melting. Since the garment was not available for examination, the staff could not determine whether the 9 month size sleeper was a complying flame resistant garment or one exempted by the 1996 amendments. Exempt infant sleepwear could be sold as of January 1997; this garment was purchased 2 to 3 months before the incident (December 1996 or January 1997). This case, however, is out of scope because it was a house fire involving a blanket and sofa, spreading quickly throughout the apartment. This large fire scenario is not addressed by the Standard.

Case #3:
This case is out of scope for two reasons. The long underwear involved was plain white with no color, pattern, or decoration. This underwear garment is specifically excluded from the standard. The fire stared with burning paper which ignited the bed covering, producing a larger ignition source that spread to the victim's underwear. This larger fire source is not represented by the Standard.

4. Comparison of Standards (garment dimensions)

Three countries incorporate maximum garment dimensions in their children's sleepwear standards to define garments of low fire risk not requiring flame resistant fabrics. A comparison of United States tight-fitting sleepwear, Canadian polo pajama, and Australian pajama dimensions for a size 6 is given in Attachment A.

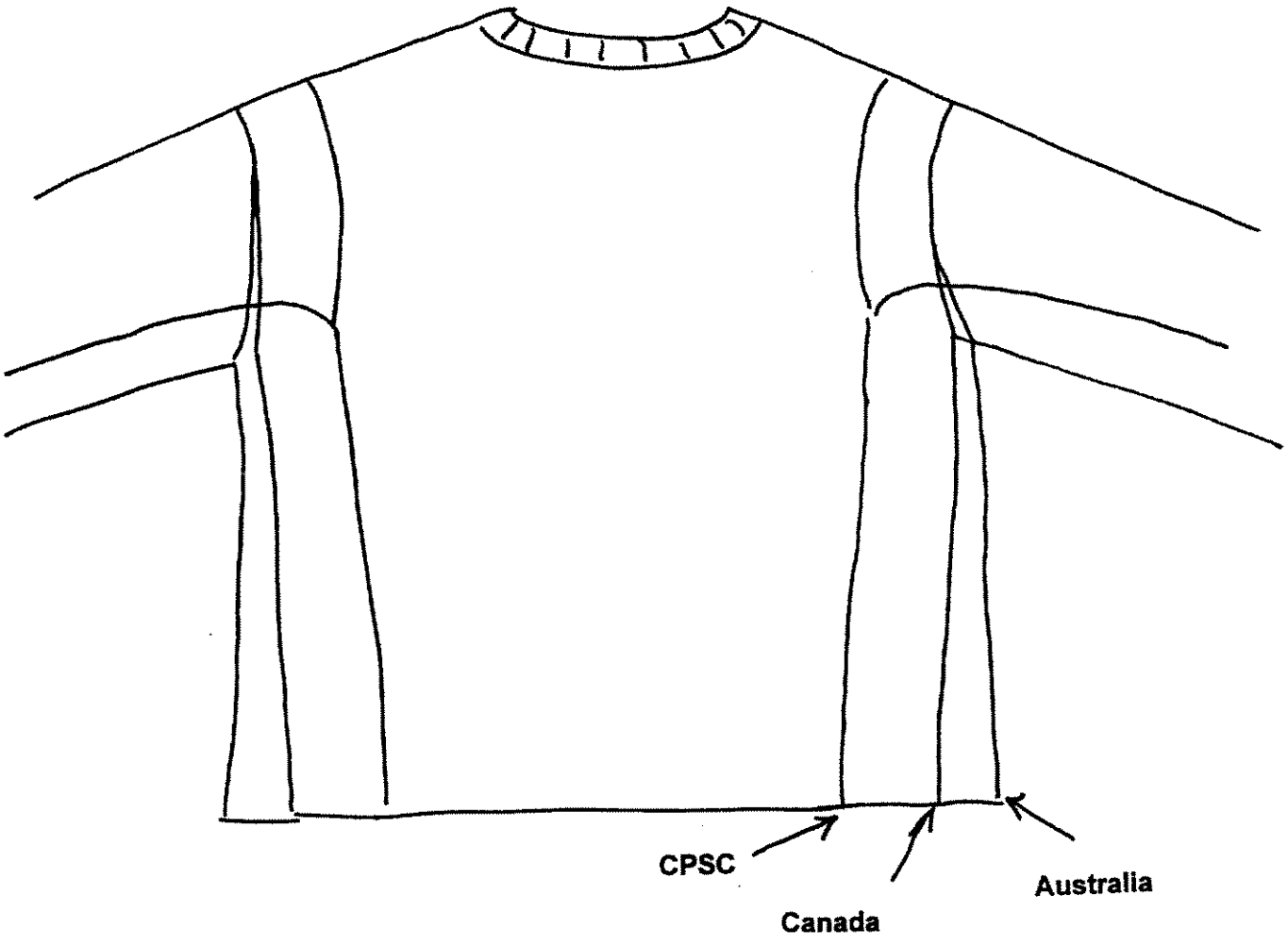
5. Labels on Tight-fitting Sleepwear

Attachment B includes examples of labels voluntarily used on tight-fitting sleepwear recently collected by Compliance. Examples include both hang tags and sewn in neck labels.

Maximum Garment Dimensions* Allowed by Various Standards
Size 6

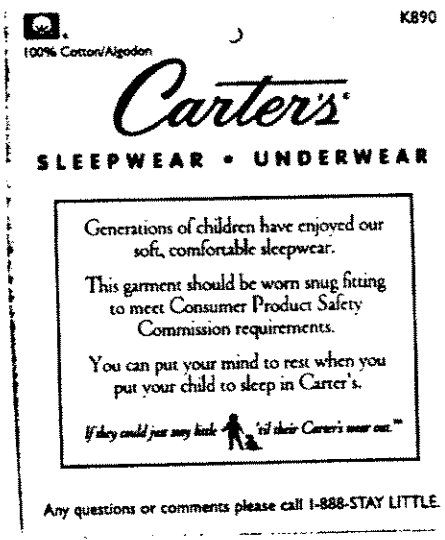
Standard	Chest	Waist	Seat	Arm	Thigh	Wrist	Ankle
CPSC	61	55.9	63.5	18.1	36.2	12.7	17.8
Canada	83	79.5			47	29.5	33
Australia		92**		34	52		

* Dimensions in cm; all requirements are converted to circumferential measurements for comparison.
**Sweep of top in Australian standard; US standard requires sweep to meet the waist dimension.



Attachment B

Nordstrom

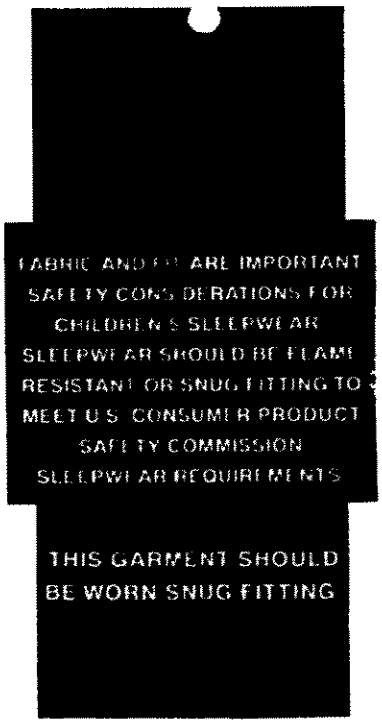


Multiple Mfgrs.

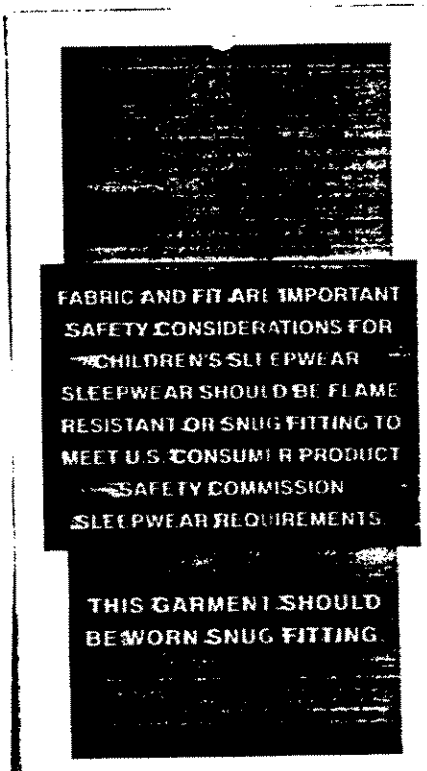
Fabric and fit are important safety considerations for children's sleepwear. Sleepwear should be flame resistant or snug-fitting to meet U.S. Consumer Product Safety Commission sleepwear requirements.

This garment should be worn snug-fitting.

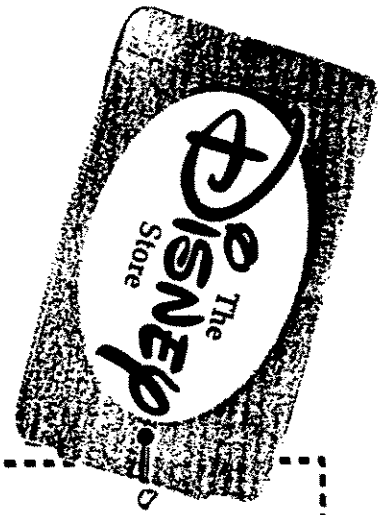
J.C. Penney



Short Eddies



Labels Sewn into Garments



SLEEPWEAR

100% COTTON

Fabric and fit are important safety considerations for children's sleepwear. Sleepwear should be flame resistant or snug fitting to meet U.S. Consumer Product Safety Commission Requirements. This Garment is designed to be snug fitting.

SIZE
3T

100% COTTON

Garment should be worn snug fitting and is not flame resistant

MADE IN HONG KONG

RN 19023

2 PC ITEM
(C) JOE BOXER
1999
GARMENT SHOULD
BE WORN SNUG
FITTING.FABRIC
IS NOT
FLAME RESISTANT
RN 19938
B64046
CUT S19-1528

SIZE 4T
100% COTTON
CARE ON REVERSE
ASSEMBLED IN
MEXICO OF U.S.
COMPONENTS

Tab J

This section is reserved for the draft Federal Register notices that will be forwarded separately to the Commission.