



UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

CPSC/OFFICE OF
THE SECRETARY

Memorandum

2000 JUN 12 P 2:35

Date. JUN 8 2000

TO : The Commission
Sadye E. Dunn, Secretary

FROM : Michael S. Solender, General Counsel *MS*
Stephen Lemberg, Assistant General Counsel *SL*
Patricia M. Pollitzer, Attorney *PM*

SUBJECT : Dive Sticks. Notice of Proposed Rulemaking

VOTE SHEET

The staff recommends that the Commission issue a notice of proposed rulemaking ("NPR") to ban dive sticks with certain hazardous characteristics. A draft Federal Register notice, which includes a draft NPR, is attached at Tab I of the briefing package.

Please indicate your vote on the following options.

I. Approve the draft Federal Register notice without change.

Signature

Date

II. Approve the draft Federal Register notice with the following changes (please specify):

Signature

Date

NOTE: This document has not been reviewed or accepted by the Commission

Initial *mlh* Date *6/8/00* CPSC Hotline 1-800-638-CPSC(2772) ★ CPSC's Web Site <http://www.cpsc.gov>

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Products Identified
 Excepted by *Pollitzer*
Notified.

III. Do not approve the draft Federal Register notice.

Signature

Date

IV. Take other action (please specify):

Signature

Date



BRIEFING PACKAGE FOR DIVE STICKS

For Further Information, Contact:
Scott Heh
Project Manager
Directorate for Engineering Sciences
301-504-0494, ext 1308

NOTE: This document has not been reviewed or accepted by the Commission

Initial ph Date 6/8/00

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Products Identified
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Executive Summary

This briefing package addresses the question of whether the U.S. Consumer Product Safety Commission (CPSC) should issue a Notice of Proposed Rulemaking (NPR) that continues a rulemaking proceeding to ban dive sticks with certain characteristics that cause them to be hazardous. The staff recommends that the Commission publish an NPR in the Federal Register that continues the dive stick rulemaking proceeding.

Dive sticks are one of several types of devices used for underwater retrieval games in swimming pools. They are typically made of a rigid plastic, and are, or can be weighted so that when dropped into water they sink and stand upright on the bottom of a pool. The CPSC staff is aware of eight impalement incidents that occurred when children jumped or fell into water and landed on a dive stick that was standing upright at the bottom of a pool or tub. These incidents resulted in injuries to the rectal or vaginal areas of children between the ages of five and nine years.

In June 1999, the CPSC Office of Compliance obtained voluntary corrective action agreements from 15 different manufacturers or importers of dive sticks that staff has determined pose a risk of impalement injury. On June 24, 1999, the CPSC staff transmitted a briefing package to the Commission that recommended initiation of a rulemaking proceeding that could result in a rule banning certain dive sticks. The Commission voted to issue an Advance Notice of Proposed Rulemaking (ANPR) that was published in the Federal Register on July 16, 1999.

In order to move forward with a proposed rule, the staff developed a definition for dive sticks that includes certain performance tests in order to differentiate those dive sticks that would be considered banned hazardous products from other products that may be used in a similar manner as dive sticks but do not pose the same risk of injury. In developing this definition, the staff focused on the following characteristics of dive sticks that were involved in impalement incidents: (1) they submerge and come to rest at the bottom of a pool of water, (2) they stand upright at the bottom, and (3) they are rigid. Dive sticks that do not have these characteristics would be exempt from the rule.

The costs associated with modifying dive sticks to reduce or eliminate the injury risk are likely to be low. CPSC staff believes that changes can be made with minimal impact on tooling and other production processes. Some manufacturers began taking steps to modify their dive sticks after the June 1999 recall and may already have models that will meet the requirements of the proposed rule. Those manufacturers whose redesigned products meet the proposed requirements will not incur additional costs. Further, there are inexpensive substitute products for dive sticks that have similar utility and recreational value, but do not present the risk of impalement injury. Consequently, it is likely that when the incremental costs of the proposed rule are spread over large production runs, the costs will not exceed the benefits of the rule — 2 to 4 cents per dive stick manufactured.



UNITED STATES
 CONSUMER PRODUCT SAFETY COMMISSION
 WASHINGTON, DC 20207

Memorandum

Date: JUN 8 2000

To : The Commission
 Sadye E. Dunn, Secretary

Through : Michael S Solender, General Counsel *MS*
 Pamela Gilbert, Executive Director *PG*

From : Ronald L. Medford, Assistant Executive Director, *RLM*
 Office of Hazard Identification and Reduction
 Scott R. Heh, Project Manager, *JN*
 Directorate for Engineering Sciences,
 (504-0494 ext 1308)

Subject : Dive Sticks

I. ISSUE

This briefing package addresses the question of whether the Commission should issue a Notice of Proposed Rulemaking (NPR) that continues a rulemaking proceeding that began with the publication of an Advance Notice of Proposed Rulemaking (ANPR) on July 16, 1999. The proposed rule seeks a ban of dive sticks with certain characteristics that cause them to be hazardous. The staff recommends that the Commission publish an NPR in the Federal Register that continues the dive stick rulemaking proceeding

II. BACKGROUND

Dive sticks are one of several types of devices used in swimming pools or other water environments for such activities as underwater retrieval games or swimming instruction. They are typically made of rigid plastic and are weighted (or can be weighted) so that when dropped into water they sink and stand upright on the bottom of a pool. The staff is aware of eight impalement incidents involving dive sticks that were upright at the bottom of a pool or tub. This includes two additional impalement incidents that were reported after the July 1999 publication of the ANPR. These injuries occurred when children jumped or fell backwards into a pool and landed on an upright dive stick. Four females (ages 7 to 9 years) sustained injuries when the dive stick penetrated the vagina. One male (age 7 years) and two females (ages 5 and 6 years) suffered injuries when the dive stick penetrated the rectum. In the remaining incident, a seven year-old female received lacerations around the rectum after landing on a dive stick.

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 Products Identified
 Accepted by *[Signature]*

As a result of an investigation by the Office of Compliance (Compliance) and product safety assessments by the technical staff, the staff determined that certain dive sticks present a risk of impalement injury to children.

In June 1999, the CPSC announced that 15 firms were recalling more than 19 million dive sticks.¹ Depending on the dive sticks owned, consumers could receive a refund, replacement, or repair of the product. On June 24, 1999, the CPSC staff transmitted a briefing package to the Commission that recommended initiation of a rulemaking proceeding that could result in a rule banning certain dive sticks. The Commission approved and issued an ANPR, which was published in the Federal Register on July 16, 1999.

The following discussion summarizes technical staff analyses of the severity and health consequences of the injuries, the incident data, the product characteristics, and the use characteristics and risk factors associated with dive sticks. The discussion also includes a summary of the comment received in response to the ANPR. This is followed by a proposed technical definition of a hazardous dive stick and a preliminary regulatory analysis. The memorandum concludes with a discussion of options available to the Commission to reduce traumatic injuries associated with dive sticks and a staff recommendation to issue a NPR.

III. DISCUSSION

A. Severity and Consequences of Penetrating Injuries to the Perineum

The Directorate for Health Sciences (HS) discussed the severity and health effects of impalement injuries to the genitalia and rectum, and the medical interventions required for the clinical management of such injuries (CPSC Memorandum, S. Nakamura, 6/22/99, from ANPR briefing package dated June 24, 1999). For dive sticks, staff defines impalement injuries as injuries that occur when impact with the dive stick results in tears to the perineum and/or when the dive stick penetrates the vagina or the rectum causing injury to the surrounding tissue or the internal organs.

While penetrating injuries account for only a very small percentage of traumatic injuries in children, they are severe. Falls on vertical objects may result in traumatic injuries to the perineum (the region of the body extending from the anus to the scrotum in males and from the anus to the vulva in females). The severity of rectal or vaginal lesions after impalement depends on the degree of penetration by the object. This, in turn, is dependent on the force of impact and the physical properties of the involved object (size and surface characteristics). The severity of injury could range from laceration to the rectum and sphincter, to puncture wounds and tears of the colon. High impact forces may also cause injuries to the vulva, vaginal canal, and blood vessels beneath the perineal skin in females. In males, such impacts may cause perforation injuries to the genitalia, urethra, ureter and bladder. All these types of perforation or laceration injuries in males and females require hospitalization and surgery.

Because of the nature of the area, the main complication after perineal injuries is lesion infection, which may lead to abscess and possible sepsis in extreme cases. To avoid subsequent

¹ In November 1999, Compliance accepted a corrective action plan from a 16th manufacturer

septic complications, the management of these pediatric injuries often requires aggressive and drastic surgical means. Perineal injuries (with or without rectal injury) often require fecal diversion (proximal colostomy), wound drainage, and the use of a broad-spectrum antibiotic in pre- and post-operative stages. The damage caused by deep penetration into the rectal or vaginal area may have devastating effects on children's health. In addition to long term physiological effects on children, these types of injuries may cause long lasting emotional trauma.

B. Summary of the Incident Data

The Directorate for Epidemiology, Division of Hazard Analysis (EPHA) provided information on the reported incidents associated with dive sticks (Tab A).

Impalement Injuries

From January 1990 to October 1999, the staff is aware of eight² impalement incidents involving vertical standing dive sticks that resulted in injuries to the vaginal or rectal regions of young children. These include two additional impalement incidents since the publication of the ANPR in July 1999.

Four females (ages 7 to 9 years) sustained injuries when the dive stick penetrated the vagina. One male (age 7 years) and two females (ages 5 and 6 years) suffered injuries when the dive stick penetrated the rectum. In the remaining incident, a seven year-old female received lacerations around the rectum after landing on a dive stick. Medical attention was sought after each incident, and five of the injuries required surgery to address multiple internal and external injuries.

The victims in seven of the reported incidents were injured while playing in shallow depths of water. Of these, four occurred in small wading pools with water levels between 12 and 24 inches. Of the remaining incidents, one occurred in a spa with unknown water depth, one occurred in a pool measuring three feet in height with approximately 27 inches of water and the final incident occurred in a bathtub with approximately 6 inches of water. The eighth incident reportedly took place in a pool; however, neither the type of pool nor the water depth is known.

Each of the incidents involved vertically-standing dive sticks. The products were cylindrical batons, approximately 7-7/8 to 8-5/8 inches long and 7/8 to one inch in diameter.

² In addition to the eight impalement incidents, another dive stick incident was reported involving an eleven-year-old girl who suffered a scratched rectum. In this case, the complainant (the victim's grandmother) described an incident that had occurred two years previously. While this injury is similar to those involving direct impact with vertical dive sticks standing at a pool bottom, the details in the incident report are not sufficient to confirm the position of the stick during impact.

Other Injuries Resulting from Contact with Dive Stick After Submersion into Pool

In addition to genital and rectal injuries, CPSC received reports of four injuries to other body parts that occurred when the victims struck vertically-standing dive sticks. These include three incidents reported since the July 1999 ANPR was released.

These four injuries occurred when the children attempted to retrieve dive sticks that were standing upright at the bottom of a pool. A female victim, age 6 years, received a facial laceration when she stuck her face in the water and her face struck the product. One boy, age 8, dove head first into the pool and hit his forehead on the product. The third victim, a 7 year-old male, jumped into the pool feet first and punctured his foot on the sharp edge of the dive stick after it broke from the initial contact. The final victim, a 9-year-old male, lacerated his back on the sharp edge of a dive stick when he dove into the pool to retrieve the product.

Tab A contains detailed summaries of each of the incidents discussed above.

C. Dive Stick and Pool Characteristics, Use Patterns, and the Risk of Injury

The Division of Human Factors (HF) provided an assessment of the product, use patterns, and risk of injury associated with dive sticks (Tab B).

Product and Pool Characteristics

The common features of the dive sticks which contributed to the injuries described above are that they: (1) were rigid, (2) stood in a relatively stable, upright position on the floor of a pool of water; and (3) were long enough and small enough in cross section to concentrate the force of impact and allow penetration of the body via the anal or vaginal opening. The injuries resulted from the impact of a vulnerable part of the body with the top surface of the stick. The sticks pose a risk of injury because when force is applied in line with the long axis of the sticks, they do not move or flex.

The characteristics of the pool are a second factor affecting the risk of injury. In seven of the 12 incidents for which the information is available, the pools were generally described as wading pools with relatively shallow depths. One pool was reported to be 12 feet in diameter, and another, a 6-foot spa; one incident occurred in a bathtub. These features (depth and size) are important for two reasons. First, water creates resistance, or drag, against the travel of the body. The deeper the water, the slower the body speed at the point of impact with the stick. At sufficient depth, the body may slow and stop before reaching the stick. The shallower the water, the higher the potential speed, and the greater the risk of injury on impact. Second, the space available affects the likelihood of impact with the stick. The smaller the area of the pool where a dive stick is placed, the greater the risk that a child jumping into the pool will strike the stick.

Use in Wading Pools

The estimated water depths reported in the incidents involving wading pools ranged from 12 to 36 inches. With a few exceptions, the descriptions of the events which occurred in shallow pools suggest that the victims were not actively using the sticks when the injury occurred; the sticks simply happened to be in the way when the child jumped or fell into the pool. This is foreseeable in the informal atmosphere of backyard pool use. Play is the point of the activity. Toys and accessories are likely to be available in or near the pool for children to use at their discretion.

This is the scenario in which serious injuries are most likely to occur, because when children are engaged in other types of play, their attention is not on the sticks. Thus, during stereotypical play, such as jumping into the water, or pushing another child into the pool, children are unlikely to be careful to avoid hitting the sticks. Because of the refractive effects of water, even if children notice a stick at the bottom of the pool, they are likely to misjudge its position.

Impact with the genitals, anus, and eyes is less likely than other body parts, simply because they comprise a small proportion of the body, and the surface area of the end of the stick is correspondingly small. Impact with the eyes is perhaps the least likely, because (consistent with the pattern in the incident reports) head or face first entry of the body into the water is expected to be uncommon both among younger children, and in shallow pools because children must propel themselves over the vertical side of the pool. More to be expected is children jumping with the knees bent and raised to enter the water with the legs forward of the trunk in a semi-sitting position. This pattern would tend to account for the more serious rectal and vaginal injuries. The likelihood of serious injury resulting from impact with the rigid stick is high, as the tissues of the rectum and vagina are vulnerable, and form a canal through which the relatively unprotected interior of the body can be penetrated.

Adults are unlikely to assess accurately the risk posed by the product in small shallow pools. Children's products in general, and, perhaps toys in particular, are assumed to be safe. The sticks are promoted as toys, and labeled for use by young children. Adult caretakers are likely to perceive the sticks as innocuous. Because the injury potential posed by the sticks is not obvious, adults have no reason to remove them from the pool simply because they are not being used at the moment.

In summary, based on the information provided in the incident reports, the factors creating the highest risk of penetration injuries due to impact with dive sticks are (1) the characteristic shape, size and behavior of the sticks in water, (2) use of the sticks in small shallow pools; (3) typical behavior of children in a recreational context; and (4) a perception among adult caretakers that the product is not hazardous

D. Types of Dive Sticks

The technical staff examined various types of dive sticks. The Directorate for Engineering Sciences, Division of Mechanical Engineering (ESME) classified dive sticks into

two categories: (1) pre-weighted and, (2) non-weighted (or weight adjustable)(CPSC Memorandum from T. Caton to S. Heh, 6/22/99, from ANPR briefing package 6/24/99). Pre-weighted dive sticks are weighted so that when dropped into water, they sink and stand upright, with the bottom of the dive stick in contact with the bottom of the pool. Pre-weighted dive sticks come in a variety of configurations. The most common pre-weighted sticks are made of rigid plastic and come in two basic types. One has a solid, X-shaped cross section, and has a weighted end cap. The second type is cylindrical, with a hollow sealed tube with an inner segment that is filled partially with sand or a similar substance. Both styles are typically about 8 inches long and less than an inch in diameter at the ends. The hollow tube style is also produced in varying diameters (about 1/2 to 1 1/2 inches) and lengths (about 4 to 10 inches). Some pre-weighted dive sticks are not cylindrical, but instead have novel shapes, such as a shark or a dolphin.

Non-weighted dive sticks are similar to the tube-shaped, pre-weighted dive sticks except that they are provided completely hollow, and have removable end caps. Package instructions for non-weighted, hollow dive sticks ranged from no instructions to detailed instructions that described the effect of filling a dive stick with various amounts of water. The behavior of these dive sticks in the pool depends on how much water is used to fill the sticks. If the dive stick is empty, it will typically float on the water surface in a horizontal orientation. By varying the amount of fill water, staff observed the following conditions:

1. The dive stick floats in a vertical orientation at the surface of the water, with its top either just below the surface or protruding slightly above the water surface.
2. The dive stick sinks to the bottom and stands vertically, with one end resting on the bottom.
3. The dive stick sinks and rests at an angle (not vertical) with the pool bottom.
4. The dive stick sinks and rests horizontally on the bottom.

Hazard Assessment of Various Types of Rigid Dive Sticks

CPSC staff considered all of the rigid, pre-weighted dive sticks (with both cylindrical and x-shaped cross sections) to pose a risk of injury due to impalement or perineal laceration. In addition, one pre-weighted dive stick that was shaped like a shark profile was also considered to pose an impalement and/or perineal laceration hazard.

For the non-weighted, hollow-tube dive sticks, the staff concluded that these also posed a risk for impalement injury and/or perineal laceration when they stand upright at the bottom of the pool. Given that the hazardous upright position is only one of several potential positions for hollow dive sticks, it is less likely that these dive sticks will present an impalement hazard as compared to pre-weighted dive sticks. However, ESME staff found that it was not difficult to adjust the fill water in many of the hollow sticks to make them sink and stand upright on the bottom of a pool. In fact, some of these dive sticks came with package markings and/or instructions indicating that the sticks will stand upright at the pool bottom.

E. Summary of Comment in Response to the ANPR

In response to the ANPR, the Commission received one comment from The Department of Fair Trading, New South Wales (NSW), Australia (Tab C). Dive sticks have been on the market in Australia for over 20 years. The NSW Department of Fair Trading is unaware of any dive stick injuries in Australia similar to those experienced in the United States. However, because of the injury pattern shown in the U.S., the Department decided to take steps to prevent dive stick impalement injuries in Australia.

On August 6, 1999, the NSW Department of Fair Trading convened a meeting to consider an appropriate plan of action in relation to the safety of dive sticks. The participants included representatives from the Safety and Standards Branch, distributors, retailers, and associations representing pool, spa, and toy manufacturers. At this meeting, they agreed to: (1) publicize the hazards associated with dive sticks, (2) require the warning "Do not use in shallow water" on the packaging and on the product, and (3) implement a Hazard Reduction Design Guide requiring underwater toys to be designed in a manner that reduces the hazard of impalement.

F. Banning Definition and Test Procedures for Dive Sticks

In order to move forward with a proposed rule that could ban dive sticks that pose a risk of impalement injury, a precise definition is needed to differentiate those dive stick items that would be considered banned hazardous products from other products that may be used in a similar manner as dive sticks but do not pose the same risk of injury.

In developing this definition, the staff focused on the following characteristics of dive sticks that were involved in impalement incidents: (1) they submerge and come to rest at the bottom of a pool of water, (2) they stand upright at the bottom, and (3) they are rigid.

Based on the staff's assessments of dive stick characteristics that contribute to the risk of impalement injury, ESME developed the following language to describe a dive stick that would be subject to the ban and to clarify what products would be exempt from the ban (Tab D).

Draft proposed § 1500.18(a)(18) specifies that the following articles are banned, "Dive sticks, and other similar articles, that are used in swimming pools or other water environments for such activities as underwater retrieval games or swimming instruction, and which, when placed in the water, submerge and rest at the bottom of the pool. This includes products that are pre-weighted to sink to the bottom and products that are designed to allow the user to adjust the weight. Dive sticks and similar articles that come to rest underwater at an angle greater than 45 degrees from vertical when measured under the test at § 1500.86(a)(7) and dive sticks and similar articles for which a maximum compressive force does not exceed 5-lbf [22 N] under the test at § 1500.86(a)(8) are exempt from this banning rule. Articles that have a continuous circular or spherical shape, such as dive rings and dive disks, are also exempt."

Draft proposed § 1500.86(a)(7) provides a test method to determine if the dive stick rests at an angle greater or lesser than 45 degrees from vertical. The dive stick is dropped into a glass-

sided container of tap water and a 45-degree gauge is aligned with the dive stick under water. If the dive stick rests in a position greater than 45 degrees from vertical, it is not subject to the rule.

The test requirement above is based on a Division of Human Factors (HF) assessment of the position of a dive stick under water (Tab E). HF concluded that the injury potential declines with the angle of impact of the body part relative to the long axis of the stick. Dive sticks designed to sit at an angle relative to the pool bottom would not remain in a fixed position under the impact of a vertical load. In this situation, the body would push the stick away. This would significantly reduce the risk of impalement injury.

The orientation of a child landing on a stick is variable, and impact at precisely the wrong angle may reorient the stick perpendicular to the bottom surface. Thus, slight deviations of the stick's position from vertical may not be adequate to preclude penetration scenarios. If the dive stick rests at an angle from vertical that is sufficiently large, both impact in line with the axis, and impact at an angle to the axis, would tend to displace the stick and limit the possibility of impalement. HF recommends a position for dive sticks under water that is at least 45 degrees from vertical to provide a sufficient safety margin to effectively limit the potential for serious injuries.

Draft proposed § 1500.86(a)(8) provides a test method to determine whether a 5-lbf compressive force can be obtained when a load is applied in line with the long axis of the dive stick. An upright dive stick is secured in a test rig that gradually applies the load at the top of the stick. If, during the test, the force gauge does not reach 5-lbf, the dive stick is exempt from the regulation.

The provisions for the test described above are based on a technical assessment by ESME and HS (Tab F). In case studies of impalement injuries to children reported in the medical literature, the objects involved were rigid and had a vertical orientation. These characteristics are also evident in the reported dive stick incidents reviewed by the staff. The staff is not aware of any impalement injuries to the perineum that involved a flexible object. Given this information, one approach to modifying dive sticks to reduce the risk of impalement injury is to make them flexible. This approach was mentioned several times in the in-depth investigations and other materials reviewed by CPSC staff.

The staff is unaware of references in the medical literature that provide information on the impact force that would be required to penetrate the rectum or vagina and cause injury. The impact forces and the extent of the injury would depend on various factors, including the size and shape of the object, the rigidity of the object, and the velocity at impact. In order to prevent serious injuries, the dive stick should be of sufficient flexibility that the stick would bend to a degree that prevents penetration when impact occurs with the perineal area.

In developing a proposed performance test that would exempt non-rigid dive sticks, the staff examined static conditions in order to formulate a conservative limiting value in relation to the larger forces associated with dynamic impact. In the static condition, the largest force applied to the dive stick occurs when a child places all of its body weight on the upright dive stick. The staff proposed test calls for the application of a gradual compression load applied

downward from the top of a vertical standing dive stick. The staff recommends that the performance criterion be set at a fraction of the weight of a 10 to 12 month-old child. According to HF, a 10 to 12-month-old child is the youngest child who may be at risk of a dive stick impalement injury (Tab G). Based on the professional judgment of CPSC technical staff, the failure criterion for the dive stick compression test is set at 5-lbf (approximately one-third the weight of a 5th percentile 10 to 12-month-old child). The staff believes that the proposed test and 5-lbf failure condition will provide a margin of safety to effectively limit the potential for serious impalement injuries by a dive stick.

Details of these test procedures are at Tab D.

G. Economic Preliminary Regulatory Analysis

The Directorate for Economic Analysis (EC) prepared a Preliminary Regulatory Analysis (PRA) for a proposed rule on dive sticks (Tab H). The proposed rule would ban dive sticks with certain characteristics that create the potential for impalement injuries when used in shallow water.

Market Information

Before the June 1999 recalls, dive sticks were usually sold in sets of 3 to 6 sticks. They were often sold as part of a package that contained other toys, such as dive disks, eggs, and rings (e.g., a package may include 3 dive sticks, 3 dive rings, and 3 dive disks). They were also sold in conjunction with things such as masks, goggles, or snorkels. Retail prices were usually in the range of \$4 to \$7 per set or about \$1 per individual stick. Retail prices were almost always less than \$10, even when sold with other products such as disks, rings, and snorkels.

Prior to the June 1999 recalls, dive sticks were widely available. They were often sold in the seasonal aisles of grocery and drug stores at many department and variety stores. Dive sticks were also available through some mail order catalogs and at various pool and water toy dealers.

Of the manufacturers and importers that were involved in the June 1999 recalls, five are currently marketing dive sticks made out of flexible material or dive sticks that do not stand upright at the bottom of the pool. Eight of the firms do not appear to be marketing dive sticks of any type at the current time. This could be because their plans for the future production and sale of dive sticks have not been finalized or because they have withdrawn from the market. Alternatively, some may not now be offering dive sticks because they did not have time to both redesign and produce the dive sticks for the summer of 2000 selling season. Staff is not aware of the plans of the remaining two firms involved in the recalls, despite efforts to contact them.

Sales and Number Available for Use

Based on information provided by several companies to the CPSC, 4 to 5 million dive sticks were sold in both 1997 and 1998. Altogether, about 20 million dive sticks have been sold since 1990. Sales of dive sticks increased substantially during the 1990's.

While the average life of a dive stick is not known with any certainty, EC believes that the average life of the product may range from 1 to 4 years. Given this product life and the historical sales data, EC estimates that an average of 3 to 5.5 million dive sticks were in use each year since 1990. Since dive sticks were sold in packages of 3-6, about 1 million households may have owned dive sticks during any given year

Benefits of a Rule Banning Certain Dive Sticks

The potential benefit of a rule that would prevent dive stick impalement injuries is the expected societal costs of the injuries prevented. The CPSC is aware of at least 8 impalement injuries (to the perineum) since 1990 involving dive sticks that were standing upright on the bottom of a pool. All of the victims received medical attention after the injury and at least 5 required surgery. In one case a temporary colostomy was performed.

The societal costs of these eight impalement injuries, based on estimates from the CPSC Injury Cost Model, range from about \$8,000 for injuries that do not require hospitalization to about \$90,000 for injuries that do require hospitalization. These estimates are based on the costs of injuries involving punctures or lacerations to the victims' lower trunk or pubic region for children 5 to 11 years-of-age. These cost estimates include the cost of medical treatment, pain and suffering, and legal and liability costs.

EC estimates the total societal costs of the known incidents at about \$474,000 or an average of \$47,400 a year since 1990. This may be a low estimate of the total societal cost of dive stick impalement injuries because it is based only on the cases known to CPSC. There may have been other injuries of which CPSC is not aware.

The average number of dive sticks in use since 1990 probably ranged from about 3 million units (assuming a one-year product life) to about 5.5 million units (assuming a 4-year product life). Therefore, the annual societal costs of dive stick injuries may range from about one cent per dive stick in use (\$47,400 ÷ 5.5 million sticks) to about two cents per dive stick in use (\$47,400 ÷ 3 million sticks).

Since dive sticks may last for one to four years, the potential benefits of the rule per dive stick (if it eliminates all impalements) may range from about 2 cents per dive stick (\$0.02 X 1 year) to about 4 cents per dive stick (\$0.01 X 4 years). The potential benefits would be higher if there have been dive stick injuries for which the Commission is not aware. Therefore, the 2 to 4 cents per dive stick probably represents a minimum estimate of the potential benefits, if all injuries can be prevented.

Potential Costs of the Proposed Rule

If the rule under consideration is adopted, manufacturers that continue to produce and sell dive sticks will have to ensure that their products conform to the requirements of the proposed rule. Some manufacturers began taking steps to modify their dive sticks after the June 1999 recalls and may already have models that will meet the requirements of the proposed rule. Those

manufacturers whose redesigned products meet the proposed requirements will not incur additional costs.

The costs of these alternatives are not known, but the CPSC staff believes that these changes can be made with minimal impact on tooling and other production processes. Consequently, it seems reasonably likely that when the incremental costs of the proposed rule are spread over large production runs, the cost will be no more than the benefits of the rule -- 2 to 4 cents per dive stick manufactured.

Impact on Small Businesses

Most of the firms that manufactured or imported dive sticks are small businesses according to the Small Business Administration guidelines. The proposed rule is unlikely to have a significant impact on a substantial number of small firms for several reasons. First, the costs of the rule are likely to be small. Second, dive sticks probably account for only a small percentage of any individual firm's sales. Additionally, any loss related to a ban on dive sticks could be offset if sales of substitute products increase.

Environmental Impact

Manufacturers that wish to market a dive stick are expected to be able to do so by making minor modifications to the previous production methods. These changes are unlikely to have an adverse impact on the environment. Therefore, the proposed rule is unlikely to have a significant impact on the use of materials, waste disposal, energy use, or otherwise affect the environment.

IV ALTERNATIVES CONSIDERED

There are several alternatives to a ban that the Commission could consider (Tab H). These include relying on a voluntary standard or recall activities, requiring a warning label on hazardous dive sticks, and changing the scope of the products subject to a ban.

Rely on a Voluntary Standard or Recall Activities

The Office of Compliance has negotiated recalls with many of the known firms that manufactured or imported dive sticks. Other firms for which recalls were not negotiated have voluntarily ceased distributing the product. The Commission could continue to recall these products when they are found, instead of banning them outright. However, this approach would require the CPSC staff to make a determination that a product was hazardous each time that a new dive stick was introduced to the market. Additionally, without the standard, potentially hazardous products would be in the marketplace while CPSC staff was making this determination.

There is no voluntary standard for dive sticks that addresses the hazard, nor was a proposed standard submitted in response to the ANPR. Even if one were developed, it would be difficult to enforce since dive sticks are inexpensive and simple to manufacture, and new firms

could easily begin distributing the product. Therefore, compliance with a voluntary standard may be low.

Labeling Only Requirement

According to the HF staff (Tab B), a warning label is the least effective approach to reducing the number of injuries. A label that is highly visible and clearly communicates the hazard could have a significant impact at the point of purchase by reducing the purchase of rigid dive sticks for use in wading pools. However, a label on the package would not remain with the product after the sale. Further, because the product is intended for use in the water, it is likely that any label attached to the dive stick itself may not last the life of the product. Moreover, the surface area on a dive stick is not conducive to designing an effective warning label. HF concluded that redesign of the product would be more effective than a warning label in reducing or eliminating the potential for serious injuries.

Changing the Scope

The scope of the rule could be modified so that it applies only to pre-weighted dive sticks. However, the staff found that consumers could weight some unweighted dive sticks so that they stood vertically when submerged. These products would then present exactly the same hazard as the pre-weighted dive sticks.

V. RECOMMENDATION

The staff recommends that the Commission publish an NPR in the Federal Register that continues a rulemaking proceeding that could result in a rule banning dive sticks with certain characteristics that cause them to be hazardous. If the Commission bans hazardous dive sticks, the staff only has to establish that a dive stick at issue fails the requirements set by the rule and enforcement action can be taken quickly.

The Office of General Counsel (OGC) prepared a draft Federal Register notice that provides a dive stick NPR (Tab I). The rulemaking would proceed under the Federal Hazardous Substances Act (FHSA). The draft NPR proposes that the dive stick rule become effective thirty days after publication of a final rule. This should not present an unreasonable burden to the industry since there should be few hazardous dive sticks on the market due to the recalls that were completed in 1999. Further, there are fairly simple methods that manufacturers can employ to redesign their products to comply with the rule. In addition, there are substitute products for dive sticks that are already widely available.

TAB A



UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: March 21, 2000

TO : Scott Heh
Project Manager, Dive Stick Team
Division of Mechanical Engineering

THROUGH : Susan Ahmed, Ph.D. *SA*
Associate Executive Director
Directorate for Epidemiology
Russ Roegner, Ph.D. *RR*
Division Director, Hazard Analysis

FROM : Debra Sweet, EPHA *DS*

SUBJECT Injury Data Related to Dive Sticks

This memorandum provides an updated summary of injury and incident data related to dive sticks. Data on emergency room-treated injuries from the National Electronic Injury Surveillance System (NEISS) are reported for the period from January 1990 through October 1999. Incident reports from the Injury and Potential Injury Incident file (IPII) are included for the same time period.

Impalement Injuries

This document was prepared primarily to report impalement injuries with dive sticks, due to the nature and potential severity of these types of injuries. The U. S. Consumer Product Safety Commission (CPSC) staff is aware of eight impalement incidents that resulted in injuries to the perineal region from dive sticks that were standing upright on a bottom surface of a pool. This includes two incidents reported since the June 1999 briefing package that contained a draft Advance Notice of Proposed Rulemaking (ANPR). Information on the eight incidents are summarized in the following paragraphs.

Four females (ages 7 to 9) sustained injuries when the dive stick penetrated the vagina. One male (age 7) and two females (ages 5 and 6) suffered injuries when the dive stick penetrated the rectum. In the remaining incident, a seven year-old female received external lacerations around the rectum after landing on a dive stick. Medical attention was sought after each incident and five of the injuries required surgery to address multiple internal and external injuries. Incident summaries are attached.

Each of the incidents involved vertical-standing dive sticks. The products were cylindrical batons, approximately $7 \frac{7}{8}$ to $8 \frac{5}{8}$ inches long and $\frac{7}{8}$ to one inch in diameter.¹ One of the dive sticks

¹ Two incident reports approximated the length between 6 and 8 inches, however, the products were not available for measurement.

was white in color, another was blue; the colors of the remaining dive sticks are unknown. In one incident, it was reported that the victim could not see the dive stick because of the white color and the faded blue numbers.

The victims in seven of the reported incidents were injured while playing in shallow depths of water. Of these, four occurred in small wading pools with water levels between 12 and 24 inches. Of the remaining incidents, one occurred in a spa with unknown water depth, one occurred in a pool measuring three feet in height with approximately 27 inches of water and the final incident occurred in a bathtub with approximately 6 inches of water.

The eighth incident (NEISS case) reportedly took place in a pool; however, neither the type of pool nor the water depth is known.

An additional incident was reported to the Commission after the June 1999 briefing package had been released. The report contains information that conflicts with our understanding of the inherent hazard pattern. This incident occurred in July 1997, but it was not reported to the Commission until June 1999. The victim's grandmother (who did not witness the incident) reported that she believed the victim, an eleven year-old female, did a backward somersault into the pool and landed on/near the dive stick. The grandmother also reported that she believed that the hollow dive stick was not filled at the time of the incident and was floating on top of the water. It was reported that the victim landed on the dive stick, resulting in a scratched rectum. However, the dive stick did not penetrate the rectum. The "floating dive stick" is the detail that is most inconsistent with the other eight impalement incidents, which all involved submerged dive sticks that were standing upright on the bottom of the pool.

The pool in this incident was described as a backyard wading pool approximately three feet high and filled with water. The dive stick was said to measure 12 inches long and was designed to be filled with sand or water to stand upright at the bottom of the pool.

Other Injuries Resulting from Contact with Dive Stick After Submersion into Pool

In addition to genital and rectal injuries, CPSC received reports of four injuries to other body parts that occurred when the victim contacted the vertically-standing dive stick after entering the pool. This includes three incidents reported since the June 1999 ANPR briefing package.

The dive sticks were thrown into the pools, as instructed, and were standing on the bottom of the pools in each of the incidents. The injuries occurred when the children attempted to retrieve the dive sticks. A female victim, age 6, received a facial laceration when she stuck her face in the water and contacted the product. One boy, age 8, dove head first into the pool and hit his forehead on the product. The third victim, a seven year-old male, jumped into the pool feet first and punctured his foot on the sharp edge of the dive stick after it broke from the initial contact. The final victim, a nine year-old male, lacerated his back on the sharp edge of a dive stick when he dove into the pool to retrieve the product.

Two of the dive sticks were plastic material, cylindrical in shape, one measuring approximately 6 inches long and one inch in diameter. The other two dive sticks were plastic objects shaped like sharks, one of them measuring 8 1/2 inches long and 1/8 inch thick.

The pools involved in the incidents ranged in water depth and pool type. Two pools each contained four feet of water, one of which was an above-ground pool and the other was an in-ground pool. Another incident occurred in an above-ground pool with between two and three feet of water. The remaining incident involved a wading pool with 18 inches of water.

Other Injuries

Six incidents, including three incident reports since the June 1999 ANPR briefing package was released, occurred when the victims were struck by a thrown dive stick. The four female (ages 4-13) and two male (ages 9 and 40) victims each were injured after being hit in the head with a dive stick. Three of the injuries were facial lacerations, two resulted in eye injuries, and one child broke a tooth. A more detailed account of the injuries is attached.

Two children were injured when they fell with the dive sticks. The first incident occurred when a four-year-old female removed the rubber ends of the dive stick and placed the toy in her mouth. While walking, the child tripped; the dive stick was forced into the roof of her mouth. The incident resulted in a laceration to the roof of the girl's mouth, but required no stitches. There are few details available for the second incident in which a seven-year-old male victim was playing in the pool and fell with the dive stick. The injury resulted in a soft palate laceration.

There are no further details on the products or the environments associated with these incidents.

Deaths

There have not been any deaths reported to CPSC that occurred from contact with dive sticks.

NOTES

The IPII data provide information about ways in which injuries happen, and can be used to note that some minimum number of cases of a particular type occurred. They are not, however, a statistically representative data base, nor a count of all incidents and injuries which have occurred. For this reason, while the information above is useful in identifying hazards and severe injuries, no conclusions about proportions or about overall size of the problem can be drawn from these data. Due to the small number of NEISS incidents, staff is unable to make a national estimate of dive stick-related injuries.

CPSC staff has been told of three additional incidents. However, these incidents have been excluded from this analysis because they either could not be verified or insufficient information was available to determine whether a dive stick was directly involved in the injury.

INCIDENT SUMMARIES

Impalement Injuries

- July 22, 1990 -- The seven year-old female victim was playing with her cousins in an above ground swimming pool. She jumped up and out of the water, tucked her knees to her chest to do a "cannon ball" jump and re-entered the water. The victim entered the water buttocks first and rapidly descended to the bottom of the pool, where her buttocks came in contact with the upright, cylindrical dive stick. The dive stick caused lacerations around the victim's rectum. No stitches were required and the victim has recovered fully
- July 22, 1993 -- The eight year-old girl was sitting on the edge of her family's spa with her feet in the water. She used her arms to push off the edge and sit on a lower step of the spa, without seeing the vertical-standing, cylindrical dive stick on the same, lower step. The dive stick slipped past the victim's swimsuit and penetrated into her vagina. Immediate medical attention was sought and surgery was performed to repair multiple internal, vaginal lacerations. Additional surgery was necessary five months later. No recovery records are available.
- July 24, 1995 -- The nine year-old female victim jumped into a swimming pool and landed on a dive stick; she landed on the perineum, causing deep vaginal lacerations.
- August 3, 1997 -- The six year-old female victim jumped into her inflatable wading pool. The victim's buttock area landed on top of the vertical-standing, cylindrical dive stick. The product and the girl's swimsuit were projected into her rectum. The victim was admitted to a children's hospital for surgery to repair perineal and external sphincter lacerations. The victim has recovered from the incident but will be examined periodically.
- June 10, 1998 -- The eight year-old female victim was playing with her brother in a wading pool. She fell backwards in the pool, landing on the cylindrical dive stick that was standing upright on the bottom of the pool. The dive stick penetrated the vagina. A physician surgically repaired the laceration with both internal and external sutures. The victim has recovered.
- June 28, 1998 -- The seven year-old boy and his brother had been playing with the cylindrical dive sticks prior to the incident. The victim ran and jumped buttock first into the wading pool. He impaled himself via the rectum on a dive stick which was standing upright in the water. Surgery was performed to repair a laceration of the rectum and a perforated intestine. A temporary colostomy was performed to allow the intestine to heal. The victim healed well, but continues to complain of abdominal pain.
- June 9, 1999* -- The five year-old female victim was playing in an inflatable wading pool. The victim was jumping up and down in the pool when she slipped and fell directly on top of one of four vertically standing dive sticks in the pool. The victim was impaled rectally by the dive stick. She was hospitalized overnight for observation. She was treated for an anal tear and an internal laceration to her rectum. The victim's mother still treats her with a stool softener.

- April 1999* -- The seven year-old female was taking a bath under the supervision of her mother. The dive stick was in the bathtub, standing vertically in the water. The child stood up to lather her legs, sat back down to rinse off and sat on a dive stick which went up into her vagina. The victim was hospitalized overnight and underwent surgery for vaginal lacerations. Long term prognosis was unavailable.
- July 1997* -- An eleven year-old female victim did a backward flip into a wading pool and landed on/near a dive stick. The dive stick was not filled (weighted) and thus floating on the surface of the water. The victim was taken to the hospital and treated for scratches to her rectum.

Other Injuries Resulting from Contact with Dive Stick After Submersion into Pool

- 1996* -- The nine year-old male victim dove into the water to retrieve a shark-shaped dive stick from the bottom surface of an above-ground pool. The boy turned while he was in the water and lacerated his back on a sharp edge of the dive stick. He received a laceration to his back which required stitches.
- August 10, 1998* -- The seven year-old male victim threw a dive stick into an in-ground pool. The boy jumped feet-first into the pool. The bottom of his foot landed on top of the dive stick breaking the product. The sharp broken edge of the dive stick punctured and lacerated the victim's foot. Stitches were required to close the wound.
- August 13, 1998 -- The six year-old female victim and three other children were in a small wading pool playing with dive sticks, shaped like sharks. The victim stuck her face into the pool to retrieve the dive stick and hit her face on the toy. She received a $\frac{3}{4}$ inch laceration below her left eye, which required sutures to close. The victim has recovered.
- June 15, 1999* -- The eight year-old male victim was playing with the dive stick in an above-ground pool. The boy tossed the dive stick into the pool, then dove head first into the pool to retrieve the product. The victim contacted his forehead on the dive stick, receiving a three centimeter wound, closed by surgical glue. The victim has recovered.

Other Injuries

- July 10, 1994 -- The nine year-old male victim received a laceration to his forehead after being hit in the head with a dive stick.
- July 14, 1996 -- The ten year-old female victim received an eye injury when she was hit in the eye with a dive stick.
- June 29, 1997 -- The seven year-old female victim received a laceration to the face when she was hit in the head with a dive stick.
- May 1998* -- The four year-old female was playing in a public pool. A child threw a dive stick and the victim had a tooth broken. No permanent damage was expected.

- June 19, 1999* -- The forty year old male was standing in an in-ground pool. His son threw a dive stick from about 20 feet away, hitting the father. The victim received a bump and laceration above his eye.
- June 21, 1999* -- The four year-old female victim tripped while walking with the dive stick in her mouth. She had taken the rubber ends off of the product and was blowing into the dive stick. When she fell, the dive stick was forced into the roof of her mouth.
- June 23, 1999* -- The thirteen year old female was hit near the eye by a thrown dive stick. She received a laceration requiring seven stitches.
- August 22, 1999* -- The seven year-old male victim was playing in a pool. The victim fell with the dive stick and received a soft palate laceration.

* -- Indicates an incident reported after the release of the June 1999 ANPR briefing package.

TAB E





UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

DATE: 10 April, 2000

TO: Scott Heh, ESME
Project Manager, Dive Sticks

Through: Jacqueline Elder, Deputy Assistant Executive Director
Office of Hazard Identification and Reduction
Robert B. Ochsman, Ph D., Director, 
Division of Human Factors (HF)

FROM: Catherine A Sedney, HF (x1282) 

SUBJECT: Human Factors Assessment of Dive Sticks

This memorandum provides a Human Factors assessment in support of the staff's effort to evaluate the risk of penetration injuries to children from a type of pool toy commonly called a dive stick. This effort is a follow-up to investigations initiated by the Office of Compliance following reports of injuries that occurred when children struck a dive stick after jumping or falling into small backyard pools. The following sections present (1) an assessment of the factors that may affect the risk of injuries to children; and (2) a discussion of product-related options to address that risk.

Background

General Product Information and Labeling

Dive sticks are one of several types of devices used in swimming pools for activities such as underwater retrieval games or swimming instruction. Based on a review of available products conducted in support of Compliance investigations, they are typically made of a rigid plastic, and are or can be weighted so that when dropped into water they sink and stand upright on the bottom. Frequently the sticks are marked with numbers for scoring, and are often made in bright colors. There are two common types of dive sticks. One is X-shaped in cross section and has a weighted end cap. The second type is a sealed hollow tube with an inner segment filled with sand or a similar substance. Both styles are typically about 8 inches long and less than an inch in diameter at the ends. The hollow tube style is also produced in varying diameters (about 1/2 to 1 1/2 inches) and lengths (about 4 to 10 inches), and may be empty, rather than weighted. The latter variety has a removable cap, and the package instructions typically indicate that it is to be weighted with water by the consumer. Depending on how it is filled, a stick of this type may float, sink at various rates, stand vertically on the bottom, or lie flat on the bottom. Also identified as dive sticks are products that have novel shapes, usually of a sea creature, such as a shark, dolphin, or sea horse.

The products are typically sold in packs of six, or multiple sticks combined with other types of dive toys, such as rings, disks, or eggs. They are often marketed with statements such as

“excellent for training” or “recommended by swim instructors.” Some products are packaged with little information. Others detail various underwater retrieval games, and provide specific instructions, such as using them only for in-the-water surface dives, and removing the sticks from the water when not in use. Most carry some warnings regarding small parts (in reference to the end caps); use only under the supervision of a competent swimmer, and/or diving in shallow water. When age grading is included, the products are generally labeled for children aged five and older.

Incident Data

The Commission is aware of 12 incidents¹ in which children struck a dive stick that was standing upright in a pool of water. The victims ranged from five to nine years of age. Eight² children jumping or falling into the water landed on an upright stick, striking the perineum, and/or penetrating the body through the rectum or vagina. Five of these resulted in injuries requiring surgery and hospitalization, in the most serious of these the victim suffered a perforated intestine and required a temporary colostomy. Two victims were treated for anal or rectal lacerations, and hospitalized for observation. For one victim, no information regarding medical treatment was reported.

The four remaining incidents resulted in injuries to other parts of the body. One child jumped into the water and struck a dive stick with his foot. The stick fractured and penetrated his foot causing a laceration that required stitches. Three children were injured while trying to retrieve a dive stick. In one case the victim dove headfirst into the water and struck his forehead on the stick. The resulting 1 1/2-inch laceration was closed with surgical glue. In the second incident, it was reported that the victim dove into a 2- to 3-foot deep pool to retrieve one or more shark-shaped dive sticks. As he turned in the water he struck a sharp edge on one of the sticks. The resulting laceration to his back required four to six stitches. In the remaining case a child was “bobbing” to retrieve a shark-shaped dive stick from the pool bottom. She collided with it, and received a laceration requiring stitches below her eye.

Some product details are given in most of the 12 incident reports. Nine of the products were described as weighted sticks, and one, simply as a stick. No further information is reported on two of the products. The remainder were either cylindrical or X-shaped in cross section, and had flat ends. Some were measured, and reported to be 7 7/8 to 8 5/8 inches long. Among those for which the length was estimated, most were reported as 6 to 8 inches, and one, as 14 inches. The diameter of the sticks was generally given as 7/8 inch to one inch in diameter. In two incidents the product had a shark-shaped profile with an ellipsoid bottom. The product dimensions were reported in one of these. The overall length of the toy was 8 1/2 inches. The shark profile was 5 3/4 inches long and 1/8 inch thick, with a blunt tip measuring approximately 3/8 inch across.

¹Eight dissimilar incidents were excluded from consideration. Three children were hit in the head, face or eye, presumably when a dive stick was thrown into the water. Two children apparently fell while mouthing a dive sticks. For the three remaining incidents little or no information is available.

²In addition to the eight impalement incidents, another dive stick incident was reported involving an eleven-year-old girl who suffered a scratched rectum. In this case, the complainant (the victim's grandmother) described an incident that had occurred two years previously. While this injury is similar to those involving direct impact with vertical dive sticks standing at a pool bottom, the details in the incident report are not sufficient to confirm the position of the stick during impact.

Information on the pools in which the dive sticks were placed is available in 11 of the 12 incidents, with five described as wading pools, three as above-ground pools, and one each an in-ground pool, a spa pool, and a bathtub. Water depth, or an estimate of it, is given in 11 of the 12 cases. The range in the wading pools was 12 to 24 inches. In one above-ground pool the depth was estimated to be 2 to 3 feet, and in one pool with 3-foot sides, was reported as 27 inches. In the in-ground pool and an above-ground pool, the water level was reported as 48 inches. In the incident that occurred in a bathtub the water depth was six inches, and in the spa pool, the dive stick was located on the first step of the pool.

Discussion

Product and Pool Characteristics

The common features of the dive sticks that contributed to the injuries described above are that they: (1) were rigid, (2) stood in a relatively stable, upright position on the floor of a pool of water; and (3) were long enough and small enough in cross section to concentrate the force of impact and allow penetration of the body via the anal or vaginal opening. The injuries resulted from the impact of a vulnerable part of the body with the top surface of the stick. The sticks pose a risk of injury because when force is applied in line with the long axis of the sticks, they do not move or flex. The injury potential declines with the angle of impact relative to the long axis. The sticks stand upright because they are lighter at the top; this also means that if struck at an angle they will move in the direction of the applied force. Because the sticks move with a force applied at an angle, the body pushes the stick away, and the risk of injury is reduced.

The characteristics of the pool are a second factor affecting the risk of injury. In seven of the 12 incidents for which the information is available, the pools were generally described as wading pools with relatively shallow depths. One was reported to be 12 feet in diameter, and another, a 6-foot spa; one incident occurred in a bathtub. These features are important for two reasons. First, water creates resistance, or drag, against the travel of the body. The deeper the water, the slower the body speed at the point of impact with the stick. At sufficient depth, the body may slow and stop before reaching the stick. Conversely, the shallower the water, the higher the potential speed, and the greater the risk of injury on impact. Second, the space available affects the likelihood of impact with the stick. The smaller the area of the pool where a dive stick is placed, the greater the risk that a child jumping into the pool will strike the stick.

Users, Use Patterns and the Risk of Injury

Unlike most products classified as "pool toys," dive sticks serve both as toys and as training devices. They are used, for example, for formal swimming instruction. They are also, as noted above, marketed as a game for use in less formal settings. Given these diverse purposes, they are likely to be purchased for use by both children and adults.

Sources indicate that the age-grading (five and older) on the products is reasonable, as children around four or five years of age are capable of learning to swim (Goodson & Bronson, 1985; p. 86), and of participating in underwater games (M. Carter, Aquatics Director, Bethesda/Chevy Chase YMCA, personal discussion, 2/2/99). Underwater exploration is included in the American Red Cross (ARC) aquatics program for children aged 6 months to 5 years, and underwater retrieval is included in early levels of the ARC "Learn to Swim" Program for children and adults.

Use in In-Ground Pools

Water familiarization and swimming classes typically are conducted in a large pool with a section deep enough to accommodate diving, and a shallow area with water levels of 3 feet or greater. Where and when one may jump in the pool, the water depth in which the sticks are placed, and use of the product in general are presumed to be under the control of a trained instructor regardless of the age of the student-users of the product. Equipment control is the norm in such settings, and dive sticks are likely to be in the water only when in use. Because of the circumscribed conditions and typical water depths, the risk of injuries due to children landing on dive sticks is minimized in supervised swimming classes.

Such control is not typical in a recreational context, and use of the product is likely to be much more casual, as with other pool toys. Children (or adults) may use the sticks in novel ways, such as a game of “keep away,” as well as in competitive retrieval games. In in-ground pools, depending to some extent on the abilities of the players, placement of the sticks is likely to be in deeper water to make the play more challenging. The larger pool area, depth of the water, and the likelihood that the toys will be in deeper, rather than shallower, water, may make the risk of perineal injuries caused by landing on a dive stick quite low. Given that the exposure of children to dive sticks in in-ground pools is likely to be high, the lack of reported incidents in this setting that resulted in perineal injuries supports the assumption of diminished risk. However, although the incidents define a clearly “unsafe” water depth for use of the sticks, insufficient information is available to specify a “safe” depth for use by children in the age group at risk.

Use in Wading Pools

Children’s play with the product in wading pools is likely to be similar to that in deeper pools, at least to some extent. The estimated water depths reported in the incidents involving wading pools ranged from 12 to 24 inches. For young beginners, this is sufficiently deep to accommodate basic underwater retrieval (e.g., simply holding the breath and submerging long enough to obtain the toy). For children who are more comfortable and experienced in the water, it is still adequate for games, such as “diving” from a position in the water and crossing the pool underwater to retrieve the sticks. This type of use appears to pose little or no risk of penetration injury.

The risk of eye and facial lacerations during retrieval of dive sticks may be somewhat greater in shallow pools because of the low water level, and the possibility that the users may be younger and/or less experienced than the typical users of in-ground pools. Many children may be reluctant to keep their eyes open when submerged. They may engage in the type of “bobbing” behavior described in one incident, by sighting the toy from above, then closing their eyes to go under the water and grab it. Because of the distortion that occurs when objects are viewed through the surface of water, children may misjudge the stick’s position and collide with it. This may pose a risk of eye injury if the toy has a sharp end, as did the stick shaped like a shark in two incidents. The potential for eye injury under these conditions (i.e., bobbing down at a relatively slow speed with eyes tightly closed) is less certain with the more common sticks, which have flat round ends.

In somewhat deeper pools, the risk of eye and facial injuries may be exacerbated if children attempt to dive from the pool edge for the sticks. One such incident was reported to have occurred in a four-foot above-ground pool. The victim weighed 92 lbs., and was either 3 feet 9

inches or 4 feet 9 inches³ tall. He was wearing goggles at the time of the incident. He threw a dive stick into the pool, waited for it to sink to the bottom, then reportedly dove head-first into the water to retrieve it. His forehead struck the dive stick causing a laceration that his mother described as very deep. The details of the incident suggest two possibilities that could have contributed to the injury (1) Despite the use of goggles⁴ the child may have closed his eyes; or (2) Relative to the child's height and weight, the water was simply too shallow for diving, resulting in an approach speed which was too fast to avoid impact with the stick.

With a few exceptions the descriptions of the events which occurred in shallow pools suggest that the victims were not actively using the sticks when the injury occurred; the sticks simply happened to be in the way when the child jumped or fell into the pool. This is foreseeable in the informal atmosphere of backyard pool use. Play is the point of the activity. Toys and accessories are likely to be available in or near the pool for children to use at their discretion.

This is the scenario in which serious injuries are most likely to occur, because when children are engaged in other types of play, their attention is not on the sticks. Thus, during stereotypical play, such as jumping into the water, or pushing another child into the pool, children are unlikely to be careful to avoid hitting the sticks. Again because of the refractive effects of water, even if children notice a stick at the bottom of the pool, they are likely to misjudge its position. Children are also unlikely to foresee the potentially serious consequences of impact with the stick.

Adults are also unlikely to assess accurately the risk posed by the product in small shallow pools. Children's products in general, and, perhaps toys in particular, are assumed to be safe. The sticks are promoted as toys, and labeled for use by young children. The warnings against use by children under three because of small parts are likely to be familiar to parents because of their ubiquity on toy packaging. The remaining warnings address *diving* in shallow pools, not use of the sticks in shallow pools. Beyond the hazards expressed in these warnings (presuming they are read), adult caretakers are likely to perceive the sticks as innocuous. Even among agency staff members, who are used to viewing consumer products with an eye toward obscure hazards, explanation of the injury scenario is necessary before the hazard is clear. Because the injury potential posed by the sticks is not obvious, adults have no reason to remove them from the pool simply because they are not being used at the moment.

Depending on the body position when falling or jumping into the water (e.g., jumping buttocks first, doing a "belly flop," or falling/jumping in sideways or face-up), a child may strike the stick at any angle with virtually any part of the body. The buoyancy of the body in water slows the speed of impact to some extent, and over the majority of the surface of the body, the tissues (skin, fat, muscle) are both somewhat elastic and compressible, and would tend to absorb the impact. Thus, bruises to various parts of the body (unlikely to be reported because of their low severity) are the most likely injuries in this scenario.

³The Consumer Incident Report (H9960278A) and the In-Depth Investigation (IDI 990712CBB0582) report conflicting figures for the child's height, with the former stating 4'9" and the latter 3'9"

⁴Goggles typically cause little distortion of depth perception in water.

Impact with the genitals, anus, and eyes is less likely than other body parts, simply because they comprise a small proportion of the body, and the surface area of the end of the stick is correspondingly small.⁵ Impact with the eyes appears less likely, because (consistent with the pattern in the incident reports) head or face first entry of the body into the water is expected to be uncommon both among younger children, and in shallow pools because children must propel themselves over the vertical side of the pool. More to be expected is children jumping with the knees bent and raised to enter the water with the legs forward of the trunk in a semi-sitting position. This pattern would tend to account for the more serious rectal and vaginal injuries. The likelihood of serious injury resulting from impact with the rigid stick is high, as the tissues of the rectum and vagina are vulnerable, and form a canal through which the relatively unprotected interior of the body can be penetrated.

In summary, based on the information provided in the incident reports, the factors creating the highest risk of penetration injuries due to impact with dive sticks are (1) the characteristic shape, size and behavior of the sticks in water; (2) the use of the sticks in small shallow pools; (3) the typical behavior of children in a recreational context, and (4) a perception among adult caretakers that the product is not hazardous.

Options for Addressing the Risk of Injury. Warnings v. Design

Warnings and instructions are the last choice in a hierarchy of approaches to address product hazards (Fowler, 1980; Cooper & Page, 1989; Woodson, Tillman & Tillman, 1992; Sanders & McCormick, 1993):

- Design the dangerous features out of the product.
- Protect against the hazards by guarding or shielding.
- Provide adequate warnings and instructions for proper use and foreseeable misuse.

Simply providing information in the form of a warning is the least effective method. In order for a label to be fully effective, consumers must first notice, read, and understand it, then comply with it 100% of the time. Compliance is influenced by a number of factors, such as consumers' familiarity with the product, how severe they perceive the hazard or potential injuries to be, how much and how often it costs (in terms of time, effort, attention, funds, etc.) to obey the warning. In this instance, an adequate warning may have a positive impact at the point of purchase because safer alternative products (e.g., disks or rings) are available, and compliance consists of a one-time decision to buy or not to buy. The criteria for adequacy, that is, for a warning to be potentially effective in persuading consumers not to purchase the product for use in a small shallow pool, are the prominence of the label and the explicitness of the messages it contains.

Warnings often go unnoticed because they are written in small print in a lower corner, or on the back of, the package. To insure that the warning is noticed, it would have to be sufficiently conspicuous to compete successfully with the images and other text (including the brand name) on the package. Ideally, it would be the largest, boldest text on the front of the package, much like a newspaper headline.

⁵The small diameter of the sticks makes striking them less likely, but increases the likelihood of penetration on impact.

Explicitness is necessary for any warning to be credible. People are less likely to comply with a warning if the connection between the product and the injury potential is not clear, if they cannot imagine what the injury is, or if they do not fully understand how to avoid the hazard. As the hazard presented by this product is not apparent, the label would have to convey clearly that severe rectal or genital injuries can result if children jump into the water and land on the sticks. Further, a "safe" water depth would have to be identified to give consumers adequate information on which to base their purchasing decision

There are obstacles to the post-purchase effectiveness of a warning label. For example, the product may be taken to the home of another child and used in a shallow pool. Also, as with any product, it may be passed on to others (e.g., at a yard sale). Without the packaging, the new owner would be unaware of the hazard. An on-product label is unlikely to be effective in addressing these circumstances. First, it would be difficult to develop a label that is highly noticeable and easy to read because of the small and typically curved surface area of the stick. Second, a label may not last the life of the product because it is used in water.

When practical, redesign of the product is the preferred option for injury prevention, as its effectiveness does not rely on human behavior. Based on the opinions of technical staff (T. Caton, ESME; S. Nakamura, HS), an expert witness for a plaintiff injured by a dive stick (Dr. George Pearsol, Duke University), and an unnamed physician who performed surgery on one of the victims (IDI 981026CBB0050), various modifications could minimize or eliminate the potential for serious injury. Among those suggested include sticks (1) of a wider diameter; (2) made of a flexible material, and/or (3) designed to rest at an acute angle when under water, rather than vertically. Based on a limited review of currently marketed diving toys, as well as retrofits and prospective design changes proposed by manufacturers/importers of the products, these options appear feasible. It is the opinion of Human Factors that such modifications would not adversely affect the utility of the product for training or recreational use.

Conclusion

The primary risk of serious injuries due to dive sticks occurs when they are used by children in shallow pools. Injuries resulting from impact with most parts of the body are expected to be minor, impact with the perineum can result in serious injuries. A package warning label, if both conspicuous and explicit, may help reduce purchase of the product for use in such pools. Redesign of the product would be more effective in reducing or eliminating the potential for serious injuries

References

- Cooper, S. & Page, M. (1989). *Instructions for consumer products: Guidelines for better instructions and safety information for consumer products* (p. 12). Prepared for the Department of Trade and Industry by The Institute for Consumer Ergonomics. London: Her Majesty's Stationery Office.
- Fowler, F D. (1980). Failure to warn: A product design problem. *Proceedings of Human Factors and Industrial Design in Consumer Products*, 242-250.
- Sanders, Mark S & McCormick, E.J (1993). *Human Factors in Engineering and Design* (7th Ed.; p 681) New York: McGraw-Hill, Inc.
- Woodson, W E., Tillman, B. & Tillman, P (1992). *Human Factors Design Handbook* (2d Ed., p. 309). New York: McGraw-Hill, Inc

TAB C



DEPARTMENT OF FAIR TRADING

NSW Consumer Protection Agency

Office of the Secretary
Consumer Product Safety Commission
Washington, DC 20207-0001
UNITED STATES OF AMERICA
Attention Renae Rauchschtalbe

Our Ref 99/11400
Your Ref
Contact Steve Hutchison
Telephone 011 61 2 9895 0257
Facsimile 011 61 2 9895 0423
Email shutchison@fairtrading.nsw.gov.au

Fax 0015 1 301 504 0127

RE ANPR FOR DIVESTICKS

Dear Renae,

Firstly, I would like to thank the United States Consumer Product Safety Commission (CPSC) for information provided in relation to the recall of divesticks used in swimming pools. It has been most helpful

I provide the following information which I hope may assist you in relation to the advanced notice of proposed rulemaking in relation to divesticks

The Department is concerned about the injury pattern involving divesticks. It is concerned that the design of the sticks may result in them sitting upright and therefore becoming hazardous in shallow water situations

Investigation by the Safety and Standards Branch of the Department reveals that divesticks in the shape of a cylinder have been on the market in Australia for over 20 years with the shark versions only appearing in the last 18 months. The Department is unaware of injuries similar to those experienced in the United States occurring in Australia.

On the 13 May 1977 an Order was gazetted in New South Wales requiring underwater toys and games to have attached a notice stating "Warning—All underwater games are dangerous—Use only under supervision of an experienced swimmer". Several industry sources have argued that these mandatory cautions are the reason that Australia has not experienced similar injuries to the United States.

On 6 August 1999, the Department convened a meeting of representatives from the Safety and Standards Branch, distributors, retailers, Australian Retailers Association, the Swimming Pool and Spas Association and the Australian Toy Association to consider an appropriate plan of action in relation to the safety of divesticks.

The meeting agreed to:

- Publicise the hazards associated with divesticks in shallow water pools through a Government/Department media statement at the beginning of the pool season in September 1999
- Include an additional warning "Do not use in shallow water" on packaging and product.
- Implement a Hazard Reduction Design Guide requiring underwater toys to be designed in a manner that reduces the hazard of impalement. Methods of achieving include (but are not restricted to)

-2-

Any underwater product shall:

- (a) Not stand vertically on swim pool floor or sit at 75° to perpendicular (the lower the angle the better);
- (b) Not be pre weighted,
- (c) Be constructed of flexible material; or
- (d) Have a cross section of more than 3cm².


[Note: This does not preclude the use of more than one of the above methods]

Further to the above information, I have attached a copy of a Report on Divesticks prepared by the Department.

If you have any comments please contact Steve Hutchison on fax 011 61 2 9895 0423 or Email shutchison@fairtrading.nsw.gov.au

I would be interested in being informed of further developments in the United States regarding this matter.

Yours sincerely



Steve Hutchison
Senior Investigator
for Director-General
30 August 1999

NSW DEPARTMENT OF FAIR TRADING REPORT ON DIVESTICKS

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these mandatory cautions are the reason that Australia has not experienced similar injuries to the United States.

The Department is concerned about the injury pattern involving divesticks where the design of the sticks enables them sit upright and therefore be hazardous in shallow water situations

COMMENT

The CPSC advised that each of the six vaginal or rectal impalement incidents involved pre-weighted vertical-standing divesticks. The products were cylindrical batons, 200 to 219mm long and 22mm to 25mm in diameter. Medical attention was sought after each incident and four of the children required surgery to address multiple internal and external injuries after jumping or falling into the water and landing on an upright stick. A seventh incident involved a six-year-old girl who received a laceration below her eye requiring four stitches. The girl bobbed under the water and struck an upright, shark - shaped divestick she was attempting to retrieve.

The CPSC stated five of the seven incidents above occurred in backyard wading pools with an estimated water depth given as 12 to 27 inches (305 to 686mm). The other two incidents involved an unspecified pool and a spa.

The common features of divesticks that resulted in impalement injuries were: (1) they stood upright at the bottom of a pool, (2) they were essentially rigid, and (3) they were long enough and small enough in cross section to concentrate the force of impact and allow penetration of the body via the vagina or rectum. Additional factors that combine to create the highest risk of impalement injuries due to impact with divesticks are the (1) use of the sticks in small shallow pools; (2) typical behaviour of children in a recreational context, and (3) a perception among adult caretakers that the product is not hazardous.

The Department recently conducted a survey of divesticks and noted there were various types from various suppliers on the market. They are priced retail between \$10-95 for a pack of six to \$28-50 in a game pack with other dive products. The divesticks were tested in water and it was found that all would stand upright on the bottom of a pool. Some required an appropriate amount of ballast such as water to be added by the consumer while most came with ballast included. All were made of rigid plastic. Other dive products that came in packages with divesticks were also tested. With the exception of the partly flexible dive rings, which rested upright, the other products that were made of rigid plastic lay flat on the bottom of a pool. - See Attachment "D".

The opportunity for divesticks to be used in shallow water has increased with the introduction of inflatable swimming pools that have wall heights from approximately 0.4m to 0.75m.



NSW DEPARTMENT OF FAIR TRADING REPORT ON DIVESTICKS

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Approaches that may be taken in order to address the hazards presented by the products include:

- design the dangerous features out of the product.
- protect against the hazards by guarding or shielding.
- provide adequate warnings and instructions for proper use and foreseeable misuse.

MEETING OF DEPARTMENT WITH INDUSTRY REPRESENTATIVES

A meeting, organised by the Safety and Standards Branch, was held on Friday 6 August 1999. The meeting was attended by representatives of the NSW Department of Fair Trading, distributors, retailers, Australian Retailers Association and Australian Toy Association. The aim of the meeting was to formulate an appropriate plan of action regarding the continued supply or possible recall of divesticks.

Meeting Summary:

The meeting discussed the issues of

- The United States Consumer Product Safety Commission (CPSC) report and recall.
- The possibility of a ban in the United States.
- Injures in the United States. Products involved Lack of known injuries in Australia. Length of time divesticks have been on the market and number sold both in the United States and Australia.
- The performance of divesticks in water and in particular shallow water.
- The NSW law (1977) requiring all underwater toys to have a warning label attached to use only under supervision of an experienced swimmer.
- Labelling of underwater toys and additional wording such as "Do not use in shallow water".
- The design of existing divesticks and other underwater toys. Possible improvements in the design of divesticks without being design restrictive. Rigidity vs flexibility, ballast, angle in water.
- Implementation of extra warning labelling on packaging and product. The labelling of all underwater toys.

NSW DEPARTMENT OF FAIR TRADING REPORT ON DIVESTICKS

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- The effect of the decisions of the meeting on local and world markets, distributors and retailers. Lead times for implementation of decisions.

Meeting Conclusions:

- Notwithstanding the lack of injuries in Australia, the significance of those injuries reported in the United States required action by Australian suppliers.
- The existence of mandatory cautionary labelling in Australia (as a result of the NSW Product Safety Order) would have an effect on injury. However the extent of that effect is unknown.
- The combination of divesticks, or other underwater toys and shallow water was extremely hazardous, creating a potential for penetration injuries and impact injuries.
- The design of divesticks may be altered to reduce the potential for penetration injury and not affect the performance of the product.
- Divesticks have been marketed and used in Australia for over 20 years. They have genuine play value and there have been no reports of injuries
- Notwithstanding decisions made in the Australian market place, decisions to impose restrictions in the larger US market place will impact on the Australian market.

The meeting agreed to:

- (a) Publicise the hazards associated with divesticks in shallow water pools. A Government/Department media statement should be timed for release in early September 1999.
- (b) Include a warning "Do not use in shallow water" on packaging and products. This warning would be additional to the wording already required by the 1977 Product Safety Order which states "Warning—All underwater games are dangerous—Use only under supervision of an experienced swimmer". The additional wording would initially be placed on the packaging of the product ex distributors by 1 October 1999 and placed on products imported after 1 July 2000 Importers will require the wording on all future orders placed with manufacturers.
- (c) Redesign the divesticks to reduce or remove the potential hazard.



- (d) Implement the following hazard reduction design guide for underwater toys (formulated at the meeting) for products imported after 1 July 2000:

Hazard Reduction Design Guide

"Underwater toys are to be designed in a manner that reduces the hazard of impalement".

Methods of achieving this reduced hazard include (but are not restricted to):

Any underwater product shall:

- (a) Not stand vertically on swim pool floor or sit at 75° to perpendicular (the lower the angle the better);
- (b) Not be pre weighted;
- (c) Be constructed of flexible material; or
- (d) Have a cross section of more than 3cm²

[Chairman's Note This does not preclude the use of more than one of the above methods]

Alan Turner
Assistant Investigator
Safety & Standards
23 August, 1999



(Information published in this report is CONFIDENTIAL and is not for wider distribution)

NEWS from CPSC



U.S. Consumer Product Safety Commission

Office of Information and Public Affairs

Washington, DC 20207

FOR IMMEDIATE RELEASE

June 24, 1999

Release # 99-127

CONTACT: Jane Francis

(301) 504-0580 Ext. 1187

CPSC, Firms Announce Swimming Pool Dive Stick Recall Because of Impalement Risk to Children

WASHINGTON, D.C. - The U.S. Consumer Product Safety Commission (CPSC) and 15 firms are announcing the recall of more than 19 million dive sticks used in swimming pools. In shallow water, children can fall or land on a dive stick and suffer rectal or vaginal impalement. Facial and eye injuries also are possible when children attempt to retrieve the sticks under water. According to CPSC Chairman Ann Brown, these dives sticks are dangerous and should not be used.

CPSC knows of six impalement injuries and one facial injury to children 6 to 9 years old. Although the number of reported incidents is relatively low, the severity of the injuries that have occurred is very significant. Three of the children suffered rectal and three suffered vaginal impalements from dive sticks placed in backyard pools or, in one case, a hot tub. In four of the six incidents, the injuries that occurred required surgery and hospitalization. The facial injury occurred when a child bobbed down to retrieve a dive stick and lacerated her face just below her eye, requiring stitches.

The dive sticks being recalled are hard plastic and are either cylinder-shaped or shark-shaped. When dropped into water, the dive sticks sink to the bottom of a pool and stand upright so that children can swim or dive down and retrieve them. The cylinder-shaped plastic sticks measure about 4 to 8 inches long and about 1 inch or less in diameter. The shark-shaped plastic sticks measure about 7 inches long and have an egg-shaped bottom. The sticks come in a variety of colors. Most are packaged in kits of three to six sticks, and some are packaged with other pool diving games.

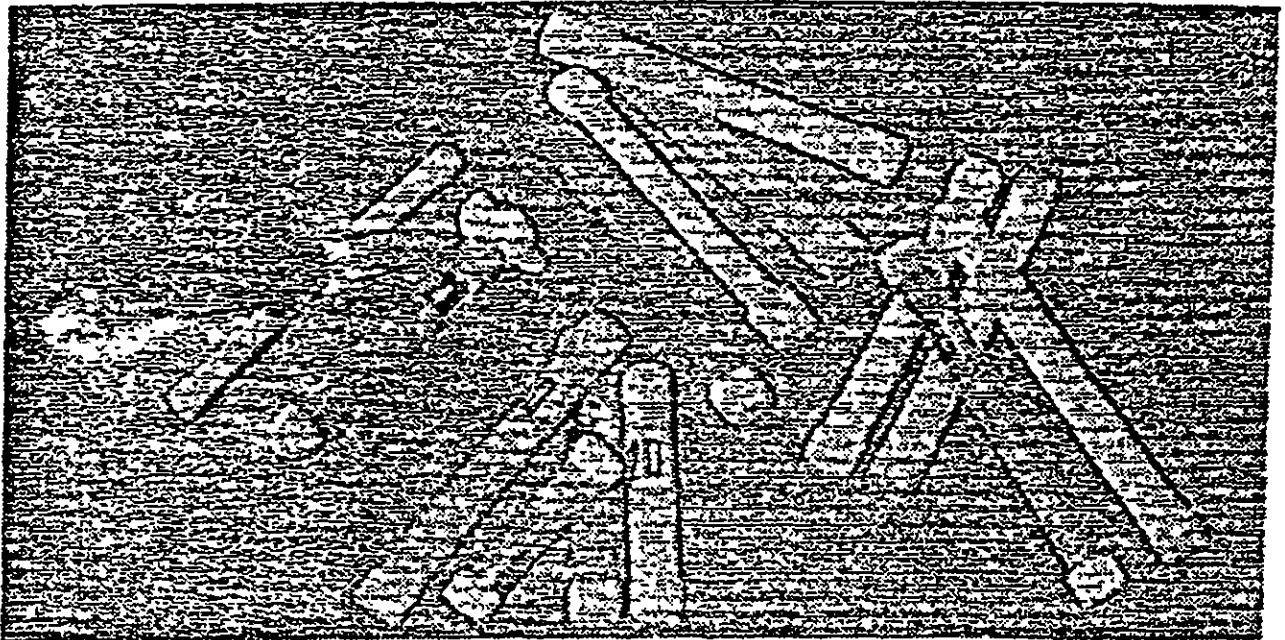
These dive sticks have been sold at grocery, drug, pool and discount department stores nationwide for about \$4 to \$7 per set under numerous brand names, most of which do not appear on the dive stick itself. Consumers should stop using dive sticks immediately and throw them out.

Depending on the sticks owned, consumers can receive a refund, replacement or repair.

Company	Quantity Recalled	How to ID	Throw out or...
<u>Florida Pool</u>	9 million	Sold primarily at Wal-Mart	Get repair kit at Wal-Mart.
<u>Poolmaster</u>	2 million	"Poolmaster" imprinted on stick	Call (800) 854-1492 for a replacement.
<u>J&M Industries</u>	897,000	"Made in USA" imprinted on stick	Get a replacement stick at the store where purchased.
All others	N/A	All others	Return to store where purchased for a refund or repair.

CPSC urges anyone who is aware of injuries with dive sticks or who has questions about the recall to call CPSC's hotline at (800) 638-2772.

The CPSC staff is recommending to the Commission that it ban the future production and importation of these products.



The U.S. Consumer Product Safety Commission protects the public from unreasonable risk of injury or death from 15,000 types of consumer products under the agency's jurisdiction. To report a dangerous product or a product-related injury and for information on CPSC's fax-on-demand service, call CPSC's hotline at (800) 638-2772 or CPSC's teletypewriter at (800) 638-8270. To order a press release through fax-on-demand, call (301) 504-0051 from the handset of your fax machine and enter the release number. Consumers can obtain this release and recall information or report product hazards to mfo@cpsc.gov.

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(B)



BRIEFING PACKAGE FOR DIVE STICKS

June 1999

For Further Information, Contact:
 Scott Heh
 Project Manager
 Directorate for Engineering Sciences
 301-504-0494, ext. 1308

NOTE: This document has not been reviewed or accepted by the Commission.
 Initial *rh* Date *6/24/99*

DPSA's (b)(7) Cleared
 No MIRA/Prohibits etc
 Product Limited
 Exempted by _____
 Filed Pursued

Executive Summary

This briefing package addresses the question of whether the Commission should issue an Advance Notice of Proposed Rulemaking (ANPR) that initiates a rulemaking proceeding that could result in a rule banning dive sticks with certain characteristics that cause them to be hazardous.

Dive sticks are one of several types of devices used for underwater retrieval activities in swimming pools. They are typically made of a rigid plastic, and are, or can be weighted so that when dropped into water they sink and stand upright on the bottom of a pool. The U.S. Consumer Product Safety Commission (CPSC) staff is aware of six impalement incidents involving dive sticks that resulted in injuries to the vaginal or rectal regions of young children. These injuries occurred when the children jumped or fell backwards into a pool and landed on a dive stick that was standing upright on the bottom of the pool. Three females (ages eight to nine) sustained injuries when the dive stick penetrated the vagina. One male (age seven) and one female (age six) suffered injuries when the dive stick penetrated the rectum. In the sixth incident, a seven-year-old girl received lacerations around the rectum after landing on a dive stick.

These injuries prompted investigations by the CPSC Office of Compliance into various dive stick products. CPSC staff has sought and obtained voluntary corrective action agreements from 15 different manufacturers or importers of dive sticks that staff has determined pose a risk of impalement injury.

The common features of dive sticks that resulted in impalement injuries were: (1) they stood upright at the bottom of a pool, (2) they were essentially rigid, and (3) they were long enough and small enough in cross section to concentrate the force of impact and allow penetration of the body via the vagina or rectum. Additional factors that combine to create the highest risk of impalement injuries due to impact with dive sticks are the (1) use of the sticks in small shallow pools; (2) typical behavior of children in a recreational context; and (3) a perception among adult caretakers that the product is not hazardous.

A mandatory ban of hazardous dive sticks would be a more effective and efficient way of keeping hazardous dive sticks out of the market than reliance on corrective actions. If the Commission bans hazardous dive sticks, the staff only has to establish that the dive stick at issue fails the requirements set by the rule and enforcement action can be taken quickly.

The costs associated with modifying dive sticks to reduce or eliminate the injury risk are likely to be low. In addition, there are inexpensive substitute products for dive sticks that have similar utility and recreational value, but do not present the risk of impalement injury.

The staff recommends that the Commission publish an Advance Notice of Proposed Rulemaking (ANPR) in the Federal Register that initiates a rulemaking proceeding that could result in a rule banning hazardous dive sticks.



DEPARTMENT OF FAIR TRADING - Safety and Standards Branch

[Published in NSW Government Gazette No 47 of 13th May, 1977.]

CONSUMER PROTECTION ACT, 1969

ORDER UNDER SECTION 39E (1)

I, the Minister for Consumer Affairs, having considered and agreed with a recommendation made to me by the Products Safety Committee, in pursuance of section 39E (1) of the Consumer Protection Act, 1969, do allow the supply of underwater toys and games only subject to the following conditions:

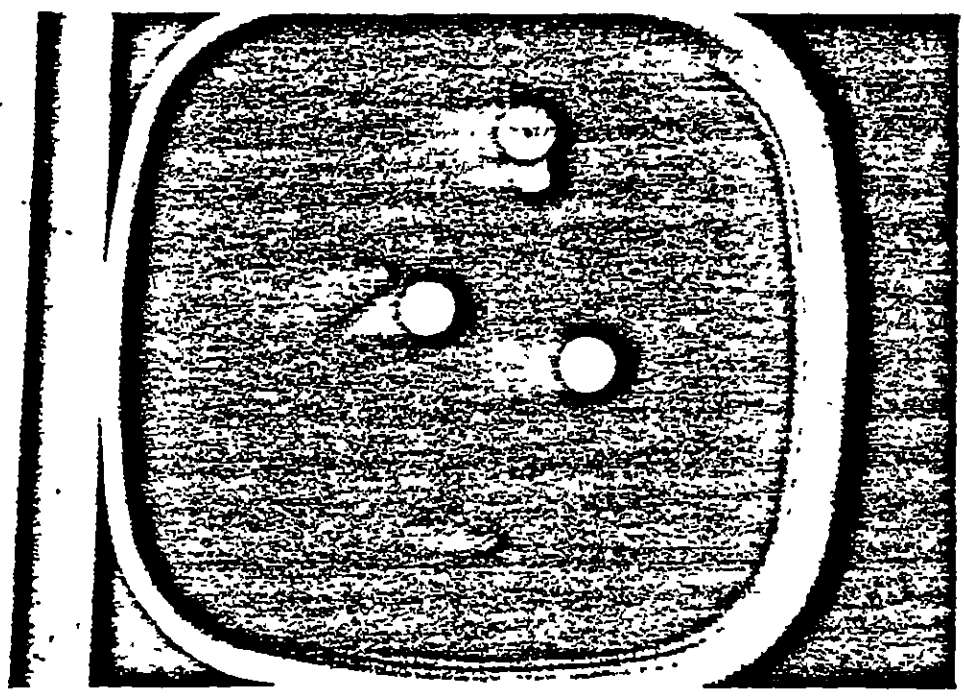
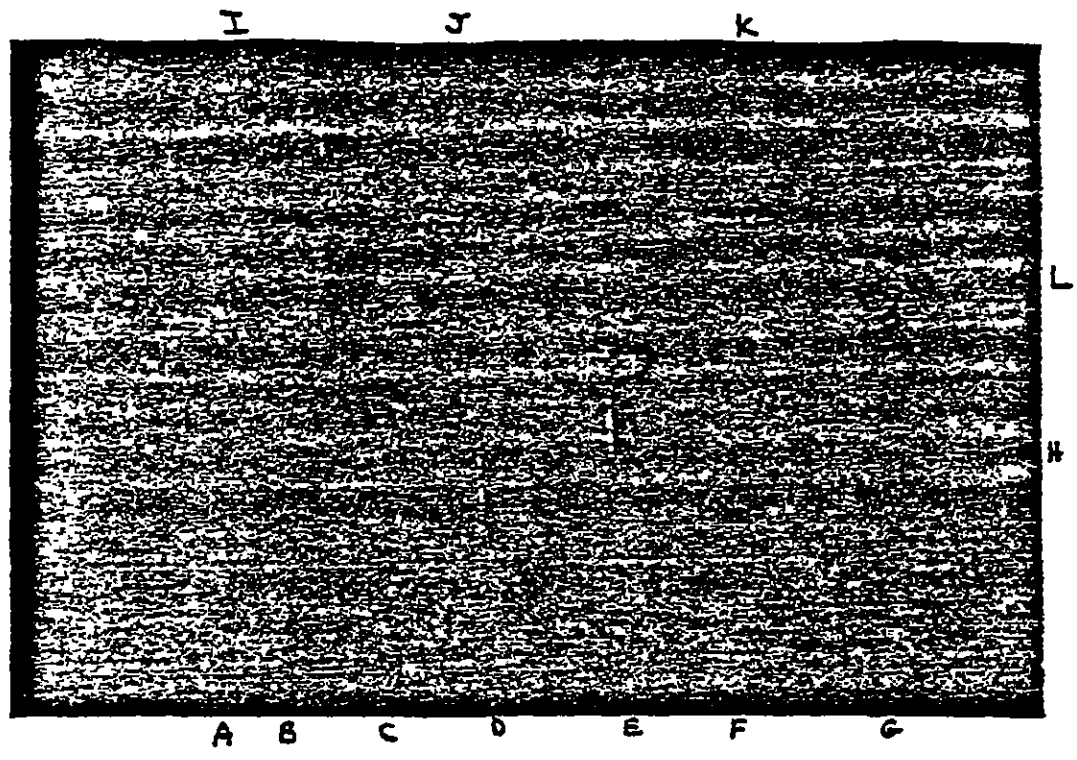
- (1) All underwater toys and games and any container or packaging in which such goods are supplied shall bear a notice stating-

WARNING—ALL UNDERWATER GAMES ARE DANGEROUS—USE ONLY UNDER SUPERVISION OF AN EXPERIENCED SWIMMER.

- (2) The notice shall be permanently and conspicuously affixed to the toy or game and the container or packaging in which such goods are supplied.
- (3) The notice shall be printed in English in characters which contrast with the background colour of the toy or game and the container or packaging in which such goods are supplied and shall contain no reference other than the warning contained in clause (1)
- (4) The wording of the notice shall be clearly legible, and, in the case of the container or packaging in which such goods are supplied, the characters shall be not less than 2.5mm high.
- (5) A reference in this order to a toy or game is, in the case of a toy or game having more than one part, a reference to each part of the toy or game

SYDNEY D EINFELD,
Minister for Consumer Affairs.

Sydney, 13th May, 1977.





DIVE STICKS

The following dive items were placed into a bucket of water and observed.

DESCRIPTION	MODIFY BALLAST	POSITION IN WATER	COMMENT
(A).	No. Weighted.	Vertical on bottom of bucket	Ballast can move 95% filled
(B)	No Weighted	Vertical on bottom of bucket	Ballast can move. 95% filled
(C).	Yes Add water.	100% full horizontal on bottom of bucket. Part full of water sits vertical.	Height of stick in water depends on amount of water in it as ballast.
(D).	Yes. Add water.	100% full including head horizontal on bottom of bucket. Part full of water sits vertical	Height of stick in water depends on amount of water in it as ballast.
(E)	No. Weighted	Vertical on bottom of bucket after some water enters stick. Propeller at top	Hole in stick allows water in.
(F)	No Weighted	Vertical on bottom of bucket	Some ballast can move Not completely filled
(G).	Not apply	Falls flat on side on bottom of bucket	No ballast
(H)	No Weighted.	Vertical on bottom of bucket after some water enters egg.	No sharp points or edges Holes in egg allows water in.
(I)	No. Weighted	Vertical on bottom of bucket.	Plastic weight at bottom of Seahorse
(J).	No. Weighted.	Vertical on bottom of bucket.	White plastic weight in ting belly of fish.
(K).	No. Weighted.	Vertical on bottom of bucket	Ballast can move. 80% filled
(L).	Not apply.	Falls flat on side on bottom of bucket	No ballast.

Alan Turner
 Safety and Standards
 29 July 1999

TAB C



UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: May 3, 2000

To : File

Through : David Walden, Associate Executive ^{DAW}
Director, Directorate for Engineering Sciences
Nick Marchica, Director, Division of Mechanical Engineering ^{hvm}

From : Scott Heh, ^{SH} Dive Stick Project Manager, Division of Mechanical Engineering, x-1308

Subject: Banning Definition and Test Methods for Dive Sticks

On July 16, 1999, the U.S. Consumer Product Safety Commission (CPSC) published an Advance Notice of Proposed Rulemaking (ANPR) that seeks a ban of dive sticks with certain characteristics that cause them to be hazardous. In order to move forward with a proposed rule that could ban dive sticks that pose a risk of impalement injury, a precise definition is needed to differentiate those dive stick items that would be considered banned hazardous products from other products that may be used in a similar manner as dive sticks but do not pose the same risk of injury.

In developing this definition, the staff focused on the following characteristics of dive sticks that were involved in impalement incidents: (1) they submerge and come to rest at the bottom of a pool of water, (2) they stand upright at the bottom, and (3) they are rigid.

The Division of Human Factors (HF) examined the issue of the position of a dive stick under water (Tab E). HF concluded that the injury potential declines with the angle of impact of the body part relative to the long axis of the stick. Dive sticks designed to sit at an angle relative to the pool bottom would not remain in a fixed position under the impact of a vertical load. In this situation, the body would push the stick away. This would significantly reduce the risk of impalement injury.

The orientation of a child landing on a stick is variable, and impact at precisely the wrong angle may reorient the stick perpendicular to the bottom surface. Thus, slight deviations of the stick's position from vertical may not be adequate to preclude penetration scenarios. If the angle of the stick is sufficiently acute, both impact in line with the axis, and impact at an angle to the axis, would tend to displace the stick and limit the possibility of impalement. HF recommends a position for dive sticks under water that is at least 45 degrees from vertical to provide a sufficient safety margin to effectively limit the potential for serious injuries.

Rigidity

The Directorate for Health Sciences (HS) and The Directorate for Engineering Sciences (ES) discusses the development of an exemption for certain non-rigid dive sticks (Tab F). In this analysis, the staff examined static conditions in order to formulate a conservative limiting value in relation to the larger forces associated with dynamic impact. In the static condition, the largest force applied to the dive stick occurs when a child places all of his/her body weight on the upright dive stick. A person's effective body weight will be less in water. However, due to the shallow water conditions described in the incident reports and the lengths of the dive sticks, the effective water depth when the child struck the stick is minimal based on several incident scenarios and is therefore ignored for purposes of this analysis.

The proposed performance test calls for the application of a gradual compression load applied downward from the top of a vertical standing dive stick. The CPSC staff recommends that the performance criterion be set at a fraction of the weight of a 10 to 12-month-old child. According to the Human Factors, a 10 to 12-month-old child is the youngest child who may be at risk of a dive stick impalement injury (Tab G). Based on the professional judgment of CPSC technical staff, the failure criterion for the dive stick compression test is set at 5-lbf (approximately one-third the weight of a 5th percentile 10 to 12-month-old child). The staff believes that the proposed test and 5-lbf failure condition will provide a margin of safety to effectively limit the potential for serious impalement injuries by a dive stick.

Definition of a Banned Dive Stick and Exemptions

Based on the staff's assessments on characteristics of dive sticks that contribute to the risk of impalement injury, the Directorate for Engineering Sciences, Division of Mechanical Engineering (ESME) staff developed the following language to describe a dive stick that would be subject to the ban and to clarify what products would be exempt from the ban.

§ 1500.18(a)(18)

Dive sticks, and other similar articles, that are used in swimming pools or other water environments for such activities as underwater retrieval games or swimming instruction, and which, when placed in the water, submerge and rest at the bottom of the pool. This includes products that are pre-weighted to sink to the bottom and products that are designed to allow the user to adjust the weight. Dive sticks and similar articles that come to rest underwater at an angle greater than 45 degrees from vertical when measured under the test at § 1500.86(a)(7) and dive sticks and similar articles for which a maximum compression force does not exceed 5-lbf [22 N] under the test at § 1500.86(a)(8) are exempt from this banning rule. Articles that have a continuous circular or spherical shape, such as dive rings and dive disks, are also exempt.

§ 1500.86(a) [Exemptions from banning rules]

(7) Dive sticks and similar articles described in § 1500.18(a)(18) that come to rest at the bottom of a container of water in a position in which the long axis of the article is greater than 45 degrees from vertical when measured in accordance with the following test method:

(i) Test equipment

(A) A container that is filled with tap water to a depth at least 3 inches [76 mm] greater than the longest dimension of the dive stick. The container shall. (1) be sufficiently wide to allow the dive stick to lie along the bottom with its long axis in a horizontal position, (2) have clear side walls to permit observation of the dive stick under water, and (3) be placed on a level surface and have a flat bottom

(B) A protractor or other suitable angle measurement device that has an indicator for 45 degrees from vertical

(ii) Testing procedure

(A) If the dive stick is sold such that the consumer is required to attach an additional component(s) to the dive stick, then the product shall be tested both with and without the attachment(s).

(B) From just above the water surface, drop the dive stick into the container.

(C) Let the dive stick sink and come to rest at the bottom of the container. If the dive stick is designed so that the weight can be adjusted by adding water or other substance, adjust the weight so that the dive stick sinks and comes to rest with its long axis positioned as close to vertical as possible.

(D) Align the angle measurement device alongside the dive stick underwater and wait for the dive stick to come to rest if there is any water disturbance. Determine whether the long axis of the dive stick is greater than or less than 45 degrees from vertical.

(8) Dive sticks and similar articles described in § 1500 18(a)(18) in which the maximum force measured in the following test method is less than 5-lbf [22 N]. The test shall be conducted in the ambient environment of the laboratory and not under water.

(i) Test equipment

(A) A compression test rig that has a force gauge or equivalent device that is calibrated for force measurements with a minimum range of 0 to 5 lbf [0 to 22 N] and with an accuracy of +/- 0.1 lbf [+/- 0.44 N] or better. The test rig shall have a system to guide the force application in the vertical direction and shall have a means to adjust the rate of load application.

(B) Compression disk -- the loading device that is attached to the force gauge shall be a rigid metal disk with a minimum diameter of 1.125 inches [29 mm].

(C) Vise or other clamping device.

(ii) Testing procedure

(A) Position the bottom of the dive stick in the clamping device so that the longest axis of the dive stick is vertical. The bottom end of the dive stick is the end that sinks to the bottom of a pool of water. Secure the bottom of the dive stick in the clamp such that the clamping mechanism covers no more than the bottom ½-inch [13 mm] of the dive stick

(B) Apply a downward force at a rate of 0.05 in/sec (+/- 0.01 in/sec) [1.3 mm/sec +/- 0.3 mm/sec] at the top of the dive stick with the compression disk positioned so that the plane of the disk contact surface is perpendicular to the long axis of the dive stick.

(C) Apply the load for a period of 40 seconds or until the maximum recorded force exceeds 5-lbf [22 N].

(D) Record the maximum force that was measured during the test.