



UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
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Memorandum

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SUBJECT: 1999 – 2008 Reported Circulation/Suction Entrapments Associated with Pools, Spas, and Whirlpool Tubs, 2009 Memorandum¹

This memorandum characterizes information on circulation entrapment incidents associated with pools, spas², and whirlpool tubs that were reported to U.S. Consumer Product Safety Commission (CPSC) staff. A circulation entrapment is defined as an entrapment involving the water circulation system of a product. A multidisciplinary team of CPSC staff collaboratively developed this definition and the types of products of interest in regard to circulation entrapments. The circulation entrapment associated products that were determined to be of interest include pools, spas, and whirlpool tubs.

From 1999 – 2008, CPSC staff is aware of 83 reports of circulation entrapments including 11 fatalities, 69 injuries, and 3 no injury incidents related to pools, spas, and whirlpool tubs. Forty-eight percent of the reported incidents were associated with pools while spas and whirlpool tubs accounted for 36 and 16 percent of the reports, respectively. Of the 73 reports that mention location, 36 percent of the incidents occurred at a public location while 64 percent were at a residence. For the 80 reports of death or injury, 74 percent of the victims were under the age of fifteen with victims aged five to nine years being the largest victim age category (38 percent). The hazard scenario could be classified for 60 incidents with a reported fatality or injury. In most of these incidents, the victim was trapped by suction (43 percent). This was

¹ This analysis was prepared by the CPSC staff, has not been reviewed or approved by, and may not necessarily reflect the views of, the Commission.

² The term spa is used to refer to spas and hot tubs.

followed by issues involving broken, missing, removed or disengaged outlet covers (37 percent). The remaining incidents were categorized as “caught on outlet cover” (20 percent).

Circulation Entrapment

There were 83 reports concerning circulation entrapments for the time period 1999 – 2008. Table 1 gives the yearly frequency of reports based on incident severity (fatality, injury, and no injury).

Table 1
Reports to CPSC Staff Concerning Circulation Entrapments
Associated with Pools, Spas, and Whirlpool Tubs by Year of Incident, 1999 – 2008³

| Year | Fatality | Injury | No injury | Yearly Total |
|-------------------|----------|--------|-----------|--------------|
| 1999 | 1 | 7 | 0 | 8 |
| 2000 | 3 | 8 | 0 | 11 |
| 2001 | 0 | 6 | 0 | 6 |
| 2002 | 1 | 12 | 1 | 14 |
| 2003 | 1 | 5 | 0 | 6 |
| 2004 | 1 | 3 | 0 | 4 |
| 2005 | 0 | 10 | 0 | 10 |
| 2006 | 0 | 9 | 0 | 9 |
| 2007 ⁴ | 2 | 2 | 1 | 5 |
| 2008 | 2 | 7 | 1 | 10 |
| Total | 11 | 69 | 3 | 83 |

Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Italics denote period for which reporting is incomplete.

Table 2 provides a cross tabulation of frequency of reports by circulation entrapment severity and product type. The product category for spas also includes whirlpool tubs which were separated out due to their closer association to bathtubs.

³ Reporting is ongoing for 2006, 2007 and 2008.

⁴ One injury in 2007 was moved to a fatality in 2008 due to prolonged medical issues after the injury which resulted in death.

Table 2
 Reports to CPSC Staff Concerning Circulation Entrapments
 Associated with Pools, Spas, and Whirlpool Tubs by Product Type, 1999 – 2008

| Product Type | Deaths | Injuries | No Injury | Total |
|----------------------|---------------|-----------------|------------------|--------------|
| Pool | 8 | 31 | 1 | 40 |
| Spa | 3 | 25 | 2 | 30 |
| Whirlpool Tub | 0 | 13 | 0 | 13 |

Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

Table 3 tabulates the frequency of reports by location and circulation entrapment severity. There were almost twice as many reports received for residential locations than public locations.

Table 3
 Reports to CPSC Staff Concerning Circulation Entrapments
 Associated with Pools, Spas, and Whirlpool Tubs by Location, 1999 – 2008

| Location | Deaths | Injuries | No Injury | Total |
|--------------------|---------------|-----------------|------------------|--------------|
| Public | 4 | 21 | 1 | 26 |
| Residential | 7 | 38 | 2 | 47 |
| Unknown | 0 | 10 | 0 | 10 |

Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

Table 4 records circulation entrapment frequencies for reported fatalities and injuries by gender.

Table 4
 Fatalities & Injuries Reported to CPSC Staff Concerning Circulation Entrapments
 Associated with Pools, Spas, and Whirlpool Tubs by Gender, 1999 – 2008

| Gender | Fatality | Injury | Total Fatality & Injury |
|---------------|-----------------|---------------|------------------------------------|
| Male | 4 | 30 | 34 |
| Female | 7 | 39 | 46 |

Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

Table 5 gives the frequency of reports of victim age by circulation entrapment incident severity. Individuals in the five to nine year old category have the highest frequency of circulation entrapment reports. This is followed by the ten to fourteen year old and less than five year old categories. Together these three age categories account for 60 of the 83 reports concerning circulation entrapment.

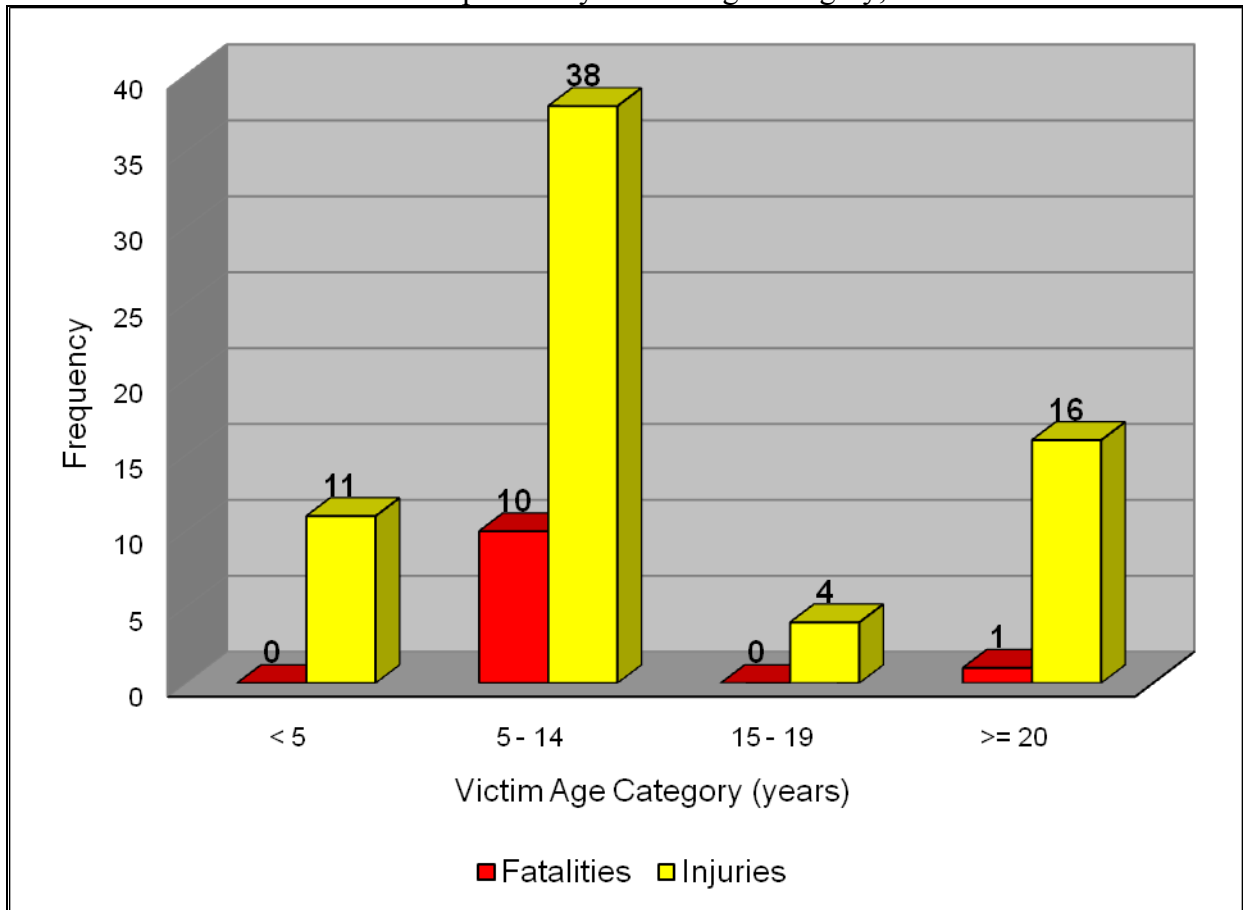
Table 5
 Fatalities & Injuries Reported to CPSC Staff Concerning Circulation Entrapments
 Associated with Pools, Spas, and Whirlpool Tubs by Victim Age Category, 1999 – 2008

| Age Category (years) | Fatality | Injury | Total Fatality & Injury |
|-----------------------------|-----------------|---------------|------------------------------------|
| < 5 | 0 | 11 | 11 |
| 5 - 9 | 6 | 24 | 30 |
| 10 - 14 | 4 | 14 | 18 |
| 15 - 19 | 0 | 4 | 4 |
| 20 - 24 | 0 | 3 | 3 |
| 25 - 29 | 0 | 1 | 1 |
| 30 - 34 | 0 | 3 | 3 |
| 35 - 39 | 0 | 4 | 4 |
| 40 - 44 | 0 | 1 | 1 |
| 45 - 49 | 1 | 2 | 3 |
| 50 - 54 | 0 | 0 | 0 |
| 55 - 69 | 0 | 2 | 2 |
| ≥ 70 | 0 | 0 | 0 |

Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

Figure 1 presents counts of reported fatalities and injuries by victim age categories for circulation entrapments associated with pool, spas, and whirlpool tubs.

Figure 1
 Fatalities & Injuries Reported to CPSC Staff
 for Circulation Entrapments by Victim Age Category, 1999 – 2008



Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

Using definitions developed by the Association of Pool and Spa Professionals (APSP), there are five types of circulation entrapment: body, limb, evisceration/disembowelment, hair, and mechanical⁵. Limb entrapment happens when a limb is sucked or inserted into an open sump. If a limb only was involved in the entrapment then the incident was coded as limb entrapment (i.e., arms, hands, legs, or feet). Evisceration/disembowelment concerns suction applied directly to the intestines. Hair entrapment occurs when hair becomes caught in an outlet cover. Incidents involving hair only were coded as hair entrapments. Mechanical entrapment stems from articles of clothing, jewelry, or appendages being caught in an outlet cover. Appendages refer to digits (i.e., fingers or toes) only involved in the circulation entrapment. Finally, body entrapment occurs when suction is applied to a large portion of the body or limbs. For our purposes, incidents were coded as a body entrapment if the entrapment involved a portion of the body not covered by the other types of entrapment. Examples of body entrapment are suction to the abdomen, back, hip, or shoulder and arm. Table 6 summarizes circulation

⁵ ANSI/APSP-7 2006, *American National Standard for Suction Entrapment Avoidance in Swimming Pools, Wading Pools, Spas, Hot Tubs, and Catch Basins*, p. viii.

entrapment incidents based on entrapment type. The majority of the reports identified limb and body entrapment. This is followed by hair and mechanical entrapment. For incidents where the exact nature of the circulation entrapment was ambiguous, the incident was categorized as “unclear.”

Table 6
Fatalities & Injuries Reported to CPSC Staff
for Circulation Entrapments by Entrapment Type, 1999 – 2008

| Circulation Entrapment Type | Fatality | Injury | Total Fatality & Injury |
|------------------------------------|-----------------|---------------|------------------------------------|
| Body | 3 | 24 | 27 |
| Limb | 4 | 23 | 27 |
| Evisceration/Disembowelment | 1 | 1 | 2 |
| Hair⁶ | 3 | 9 | 12 |
| Mechanical | 0 | 11 | 11 |
| Unclear | 0 | 1 | 1 |

Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

Hazard scenarios for the reported incidents were categorized by reviewing the report narratives and coding the incident based on the following hierarchical categories. If the report indicates that an outlet cover was broken, missing or disengaged/removed, then the incident was assigned to the respective category. If the report states that the individual was caught on the outlet cover but there is no further description of the status of the cover, the incident was characterized as “caught on outlet cover.” If the report indicates that the suction was holding the individual down but there is no further mention of the outlet, then the incident was classified as “trapped by suction.” Incidents in which neither the outlet/outlet cover nor suction were indicated were categorized as “unknown.” Table 7 enumerates the results of the hazard scenario categorizations for circulation entrapments related to pools, spas, and whirlpool tubs.

Table 7
Fatalities & Injuries Reported to CPSC Staff
for Circulation Entrapments by Hazard Scenario, 1999 – 2008

| Hazard Scenario | Fatality | Injury | Total Fatality & Injury |
|---|-----------------|---------------|------------------------------------|
| Broken Outlet Cover | 2 | 0 | 2 |
| Outlet Cover Missing | 4 | 11 | 15 |
| Outlet Cover Removed/Disengaged | 0 | 5 | 5 |
| Caught On Outlet Cover⁶ | 2 | 10 | 12 |
| Trapped By Suction | 3 | 23 | 26 |
| Unknown | 0 | 20 | 20 |

Source: CPSC databases including NEISS (National Electronic Injury Surveillance System), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations).

⁶ There was one additional hair entrapment where the victim was caught on an outlet cover with no injury and was rescued by a caregiver.

Appendix

Methodology for Extracting Reported Circulation Entrapments Associated with Pools, Spas, and Whirlpool Tubs

Data were extracted on April 23, 2009 from National Electronic Injury Surveillance System (NEISS), Injury and Potential Injury Incidents (IPII), Deaths (DTHS), and In Depth Investigations (INDP) for the product codes enumerated in Table 8 for the time period 1999 – 2008 and merged with data from last year’s memorandum to update the data for the 1999 – 2008 time frame.

Table 8 – Product Codes Used in Extracting Circulation Entrapment Data

| Product Code | Description |
|--------------|-------------------------------|
| 3221 | Above-ground swimming pools |
| 3251 | Built-in swimming pools |
| 3262 | Swimming pool equipment |
| 1246 | Wading pools |
| 1284 | Swimming pools, not specified |
| 3274 | Swimming (activity) |
| 698 | Hot tubs, Spas and Whirlpools |

Within these product codes, suction/entrapment incidents were identified using the following keyword search terms: "SUCTION", "SUCK", "STUCK", "TRAP", "CAUGHT", "HELD", "TANGLE", "UNDER", "WEDGE", "JAMM", "DRAIN", "PUMP", "FILTER", "PIPE", "INTAKE", "GRATE", "COVER", "HAIR", "LIMB", "ARM", "HAND", "FINGER", "THUMB", "LEG", "FOOT", "FEET", "TOE", "BRUISE", "DROWN", or "SUBMER". Also, all NEISS cases were reviewed that had a diagnosis of submersion (69). NEISS data is from a probability based sample. Sampling weights are used to project the cases from NEISS hospitals to national estimates provided the sample counts are large enough. Due to the small number of suction/entrapment cases in NEISS, these cases were used in the case count and not projected nationally.

Reports were reviewed to eliminate cases that did not involve circulation entrapments. It should be noted that, for a given year, incidents are included on an ongoing basis for IPII and DTHS. In particular, additional reports are generally received for the most recent years. Information from these cases was extracted into an Excel spreadsheet and sorted by incident state and date. Source documents were checked to eliminate duplicate incident reports. As fatal incidents are notable events in the community where they occur, there were often multiple news reports (IPII), a medical examiner’s report (IPII), a death certificate (DTHS), an in-depth investigation (INDP) and, less frequently, a hospital emergency department report (NEISS) for a single incident. IPII is a mixture of various types of information including newspaper clippings, consumer complaints, and reports from other government agencies such as medical examiners/coroners. Information is voluntarily submitted to IPII, so staff cannot be sure that information on all the deaths has been received. Once the incident set was established, the incidents were examined to code the additional characteristics of circulation entrapment type and hazard scenario.