



UNITED STATES
CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, DC 20207

Memorandum

Date: March 21, 2008

TO: Robert Howell
Acting Assistant Executive Director
Office of Hazard Identification and Reduction

THROUGH: Russell Roegner, Ph. D. *RR*
Associate Executive Director
Directorate for Epidemiology

Kathleen Stralka *KS*
Director
Division of Hazard Analysis

FROM: Kevin Gipson *KG*
Mathematical Statistician
Division of Hazard Analysis

SUBJECT: 1999 – 2007 Reported Circulation/Suction Entrapments Associated with Pools,
Hot tubs, Spas, and Whirlpools, 2008 Memorandum¹

This memorandum characterizes information on circulation entrapment incidents associated with pools, hot tubs, spas, and whirlpools that were reported to U.S. Consumer Product Safety Commission (CPSC) staff. A circulation entrapment is defined as an entrapment involving the 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, hot tubs, spas, and whirlpools. There is an insufficient number of National Electronic Injury Surveillance System (NEISS) cases to generate national estimates. Therefore, this memorandum presents counts of reports to CPSC staff for the time period 1999 – 2007 for all age categories. There were 74 reports of circulation entrapments including 9 fatalities, 63 injuries, and 2 no injury incidents reported to CPSC staff related to pools, hot tubs, spas, and whirlpools. Additional characteristics were coded as well for each incident such as circulation entrapment type and hazard scenario.

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.

Circulation Entrapment

There were 74 reports to CPSC staff concerning circulation entrapments for the time period 1999 - 2007. 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, Hot tubs, Spas, and Whirlpools by Year of Incident, 1999 – 2007

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
<i>2004</i>	<i>1</i>	<i>3</i>	<i>0</i>	<i>4</i>
<i>2005</i>	<i>0</i>	<i>10</i>	<i>0</i>	<i>10</i>
<i>2006</i>	<i>0</i>	<i>9</i>	<i>0</i>	<i>9</i>
<i>2007</i>	<i>2</i>	<i>3</i>	<i>1</i>	<i>6</i>
Total	9	63	2	74

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. Ambiguity exists between the various labels applied to hot tubs, spas, and whirlpools. For this reason, hot tubs and spas were counted together since these terms are used interchangeably and whirlpools were separated out due to their closer association to bathtubs.

Table 2
Reports to CPSC Staff Concerning Circulation Entrapments
Associated with Pools, Hot tubs, Spas, and Whirlpools by Product type, 1999 – 2007

Product type	Deaths	Injuries	No injury	Total
Pool	6	28	1	35
Hot tub & Spa	3	22	1	26
Whirlpool	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 by CPSC staff for residential locations than public locations.

Table 3
 Reports to CPSC Staff Concerning Circulation Entrapments
 Associated with Pools, Hot tubs, Spas, and Whirlpools by Location, 1999 – 2007

Location	Deaths	Injuries	No injury	Total
Public	2	20	0	22
Residential	7	33	2	42
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, Hot tubs, Spas, and Whirlpools by Gender, 1999 – 2007

Gender	Fatality	Injury	Total Fatality & Injury
Male	4	28	32
Female	5	35	40

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 54 of the 74 reports concerning circulation entrapment.

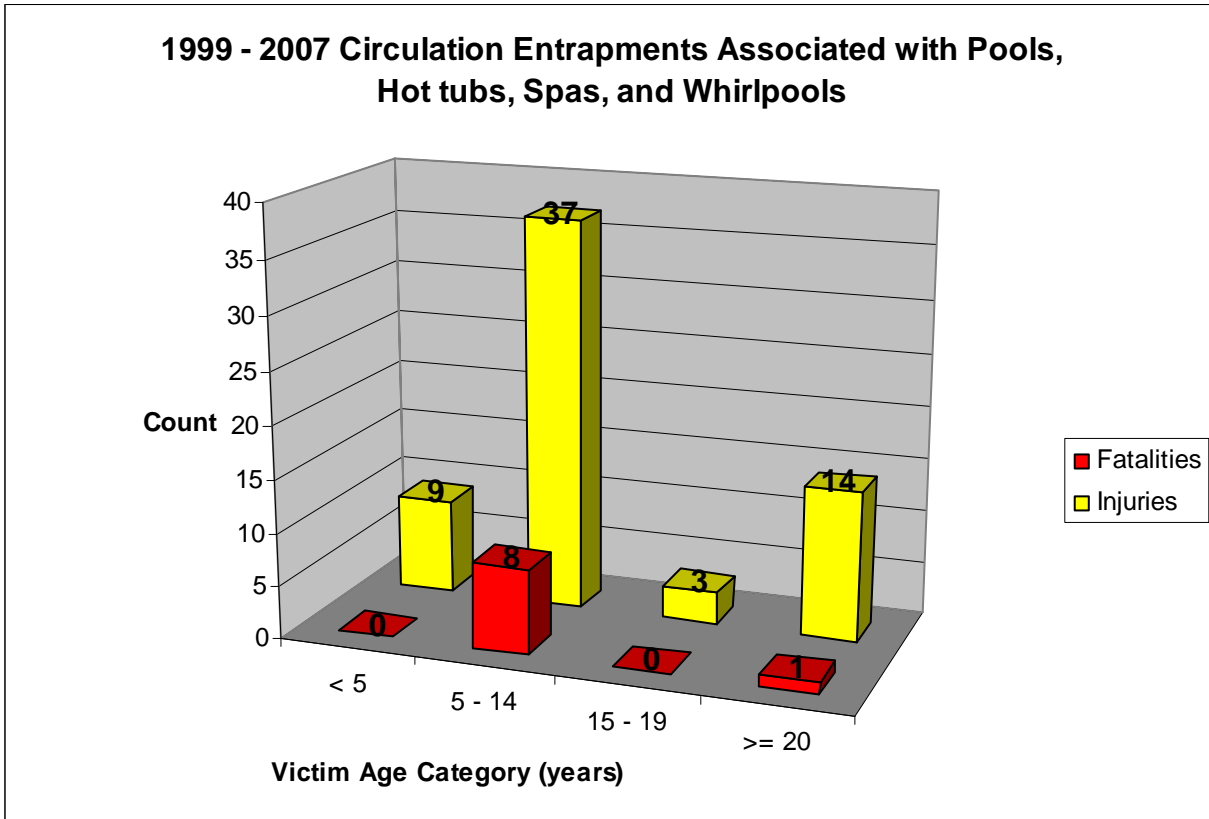
Table 5
 Fatalities & Injuries Reported to CPSC Staff Concerning Circulation Entrapments
 Associated with Pools, Hot tubs, Spas, and Whirlpools by Victim Age Category, 1999 – 2007

Age Category (years)	Fatality	Injury	Total Fatality & Injury
< 5	0	9	9
5 - 9	5	24	29
10 - 14	3	13	16
15 - 19	0	3	3
20 - 24	0	3	3
25 - 29	0	1	1
30 - 34	0	3	3
35 - 39	0	3	3
40 - 44	0	1	1
45 - 49	1	1	2
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, hot tubs, spas, and whirlpools.

Figure 1
 Fatalities & Injuries Reported to CPSC Staff
 for Circulation Entrapments by Victim Age Category, 1999 - 2007



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 mechanical². 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 caught in an outlet cover. Appendages are digits i.e., fingers or toes only involved in the circulation entrapment for the mechanical entrapment category. 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.

² ANSI/APSP-7 2006, p. viii

Examples of body entrapment are suction to the abdomen, back, hip, or shoulder and arm. Table 6 summarizes circulation entrapment incidents based on entrapment type. The majority of the reports identified limb and body entrapment types. This is followed by hair and mechanical entrapment types. The unclear category was used for incidents where the exact nature of the circulation entrapment was ambiguous.

Table 6
Fatalities & Injuries Reported to CPSC Staff
for Circulation Entrapments by Entrapment Type, 1999 - 2007

Circulation Entrapment Type	Fatality	Injury	Total Fatality & Injury
Body	3	22	25
Limb	3	19	22
Evisceration/Disembowelment	0	2	2
Hair	3	8	11
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 is broken, missing or disengaged/removed, then the respective category was assigned. 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, hot tubs, spas, and whirlpools.

Table 7
Fatalities & Injuries Reported to CPSC Staff
for Circulation Entrapments by Hazard Scenario, 1999 - 2007

Hazard Scenario	Fatality	Injury	Total Fatality & Injury
Broken Outlet Cover	2	0	2
Outlet Cover Missing	2	10	12
Outlet Cover Removed/Disengaged	0	5	5
Caught On Outlet Cover	2	8	10
Trapped By Suction	3	21	24
Unknown	0	19	19

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

Appendix

Methodology for Extracting Reported Circulation Entrapments Associated with Pools, Hot tubs, Spas, and Whirlpools

Data were extracted on February 5, 2008 from NEISS, IPII, DTHS and INDP for the product codes enumerated in Table 8 for the time period 1999-2007.

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

Due to the volume of reports in NEISS, keyword searches were used on the narratives to reduce the volume of reports to review for NEISS. The keyword search terms used were "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).

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 that 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.