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CONSUMER PRODUCT SAFETY COMMISSION  
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Memorandum

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SUBJECT: 2007 Pool Submersion Memorandum<sup>1</sup>

~~CPSC (b)(1) CLEARED for PUBLIC~~  
NO MFRS/PRVT/BLRS OR PRODUCTS IDENTIFIED *Jun 6/13/07*  
EXCEPTED BY PETITION  
RULEMAKING ADMIN. PROCD  
WITH PORTIONS REMOVED

This memorandum contains information on pool submersion incidents of children under five years old. An estimate of emergency department-treated submersion injuries is presented, along with per capita injury rates. This is followed by a count of deaths. The deaths are for 2002-2004 and the injury estimates are for 2004-2006, in both cases using the latest available data.

**Emergency Department-Treated Injuries**

For 2004-2006, an estimated annual average of 2,725 children under five years of age were treated in U. S. hospital emergency departments for injuries associated with pool submersion. Estimates are shown in Table 1. Emergency department-treated injuries varied from 2,084 in 2005 to 3,703 in 2006. Rates varied from 103 emergency department-treated injuries per million children to 181 per million children averaging 135 per million children yearly.

<sup>1</sup> 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

Table 1  
 Estimated Emergency Department-Treated Pool Submersion Injuries  
 to Children under Five Years of Age  
 2004-2006

Year	Estimated Emergency Department Treated Injuries <sup>2</sup>	Emergency Department Injuries Per Million Population <sup>3</sup>
Average	2,725	135
2006	3,703	181
2005	2,084	103
2004	2,388	119

Source: U. S. Consumer Product Safety Commission: National Electronic Injury Surveillance System (NEISS). The estimates include all cases with the diagnosis of submersion (diagnosis code 69) with at least one of the following product codes: swimming pools, not specified (1284), above ground swimming pools (3221), built in swimming pools (3251) or wading pools (1246). A few additional NEISS cases were included that indicated a pool was involved but did not have one of the above product codes for the time period. NEISS is a probability sample of U. S. hospitals that have emergency departments.

Table 1 shown above tabulates the results for injuries for the three year period. While the estimate for 2006 is larger compared to the previous two years, it is not statistically different from the 2004 or 2005 estimates. Looking at the pair wise comparisons, 2006 versus 2005, there is not a statistical difference ( $p=0.1498$ ); and 2006 versus 2004 also fails to yield a statistical difference ( $p=0.1110$ ).

Over the three year period, 52 percent of the injuries were to males and 48 percent to females. The age distribution was as follows: 9 percent of the victims were under one year of age, 28 percent were more than one year but less than two years, 28 percent were two years old, 21 percent were three years old, and 13 percent were four years old<sup>4</sup>.

The injuries resulted in the following dispositions: 46 percent or 1,266 children per year on average were admitted to the hospital, 24 percent were treated and released, 15 percent were treated and transferred, and 6 percent were held for observation. Also 9 percent died in the emergency department or died before arrival at the hospital<sup>4</sup>. This represents an annual average of 235 fatalities per year. These deaths are also counted in the deaths in the next section.

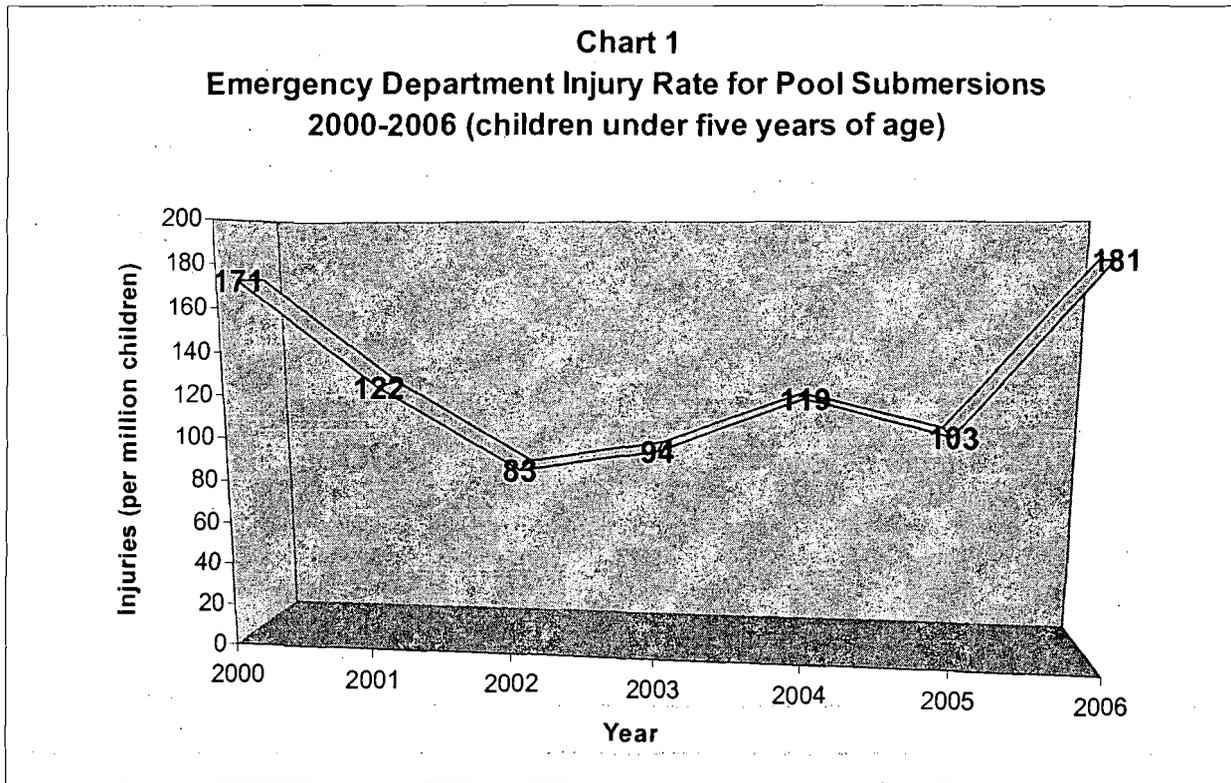
The majority of the incidents (67 percent) that led to these emergency department visits occurred at a residence. Seven percent occurred at a recreation or sports place, and 6 percent

<sup>2</sup> CV was 0.31 for 2004, 0.24 for 2005, and 0.39 for 2006.

<sup>3</sup> U. S. population for children under five from <http://www.census.gov/popest/national/asrh/NC-EST2005/NC-EST2005-01.xls> for 2004 & 2005 and [http://www.census.gov/popest/national/asrh/files/NC\\_EST2005-ALLDATA-R-File18.txt](http://www.census.gov/popest/national/asrh/files/NC_EST2005-ALLDATA-R-File18.txt) for 2006.

<sup>4</sup> Numbers do not add up to 100 percent due to rounding.

occurred at a public place, such as a community swimming pool or a hotel swimming pool. The location of the injury was not recorded for the remaining 20 percent of the injuries.



As a point of reference for 2004-2006, Chart 1<sup>5</sup> above records the current estimates along with previous estimates. The injury rate has some fluctuation between 2000 and 2006. There appears to be a downward trend from 2000 to 2002 where the lowest point in the seven year period occurs. From 2002 to 2006, it appears to be rising again to levels a little higher than in 2000. However, the statistical test for trend is not significant ( $p=0.4544$ ).

<sup>5</sup> NEISS injury estimates for pool submersions are 3,286 for 2000, 2,364 for 2001, 1,625 for 2002, and 1,852 for 2003.

## Deaths

Table 2 shows the number of pool-related submersion deaths. CPSC staff has reports of 769 fatalities of children under five years of age during 2002-2004. Sixty-nine percent of the fatalities occurred on the same day as the submersion. Twenty-five percent of the victims succumbed days, weeks, and even years after the submersion, often after extensive medical treatment.

Table 2  
Pool Submersion Deaths to Children under Five Years of Age  
2002-2004

Year <sup>6</sup>	Deaths <sup>7</sup>	Deaths per Million Population <sup>8</sup>
Average	256	13
2004	230	11
2003	279	14
2002	260	13

Source: CPSC databases including NEISS (See Table 1 above), IPII (Injury and Potential Injury Incidents), DTHS (Deaths) and INDP (In Depth Investigations). Italics denote period for which reporting is incomplete.

Of the reported fatalities of children younger than five years of age during 2002-2004, 66 percent were males and 34 percent were females. The age distribution was as follows: 3 percent less than one year, 35 percent one year, 33 percent two years, 17 percent three years, and 12 percent four years. The pattern for age distribution is similar to injuries with the majority of fatalities occurring for children in the age categories of one year to less than three years of age.

Table 3  
Pool Submersion Locations for Deaths to Children under Five Years of Age  
2002-2004

Location	Percent in Category
Home pool	51
Unknown	17
Family/Friend pool	16
Public/Community/Business pool	9
Neighbor pool	8

<sup>6</sup> DTHS and IPII are updated on an ongoing basis.

<sup>7</sup> The numbers for 2002 & 2003 are lower than those reported in the memorandum of May 5, 2006 due to the elimination of duplicate records. This is described in the appendix.

<sup>8</sup> U. S. population for children under five from <http://www.census.gov/popest/national/asrh/NC-EST2005/NC-EST2005-01.xls>.

Based on examination of incidents it was determined that, like injuries, most of the deaths (75 percent) occurred at a residence as Table 3 on the previous page shows. Tabulated estimates of deaths are recorded as percentages by the type of residence because residence type implies different levels of proximity, familiarity, and safety awareness. Sixty-seven percent of the fatal incident records did not have the type of pool recorded. Of the remainder, 14 percent of the deaths involved in-ground pools, 14 percent involved above-ground pools, and 5 percent involved portable pools.

Analyzing the narratives of records for 2002-2004 allowed classification of common scenarios. Sometimes an incident involved several factors. For these incidents, the scenario was classified by the factor closest to the child finding his/her way into the pool. For example, consider the following scenario: a child exits the house undetected by adults and finds his way to the neighbor's house which has a fenced in pool. The gate has been left open at the neighbor's and the child drowns in the neighbor's pool. In this case, barrier integrity would be the factor closest to the child finding his way into the pool. In 44 percent of the deaths, too little information was available to determine the scenario. A child managed to leave the house undetected and make his/her way to the pool in 137 (18%) of the deaths. In many of those deaths, a barrier between the pool and house did not exist. Information indicated that adults had lost contact or knowledge of the whereabouts of the child and during this time period the child managed to access the pool for 107 deaths (14%). In 71 deaths (9%), the barrier, usually a fence, was not secure or did not prevent access from the pool. For 60 deaths (8%), the child had easy access to the pool. In many of these cases, a child was playing in close proximity to the pool and managed to find his/her way into the pool. In 5 percent of the deaths, the child was in or near the pool with others when the submersion occurred. For 2 percent of the deaths, children circumvented the barrier mostly by climbing over a fence. The remaining 1 percent was classified as miscellaneous due to a set of very unusual circumstances occurring such as an adult tripping and unintentionally falling into the pool while carrying a child<sup>9</sup>.

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<sup>9</sup> Numbers do not add up to 100 percent due to rounding.

## Appendix

### Methodology for Estimating Pool Submersion Deaths and Injuries

In previous memoranda, the term drowning has been used to refer to the incident. This year, the terminology has switched to using submersion which more accurately reflects the event that has occurred. Drowning is defined as suffocation and death resulting from filling of the lungs with water or other substances or fluid, so that gas exchange becomes impossible. A near drowning is survival for any length of time after submersion in water and temporary suffocation. Submersion is defined as the act of placing or the condition of being under the surface of a liquid<sup>10</sup>. For this reason and since a considerable number children are injured or do not die immediately, the term submersion better encompasses the various events that have occurred.

In last year's Annual Drowning Memorandum<sup>11</sup>, swimming pool submersion deaths were reported as 287 for 2003 and 282 for 2002. For both of these years, the number of reported fatalities is larger than the number shown in this year's report. The difference between the number of reported fatalities for each year resulted from careful examination of incidents to remove duplicates.

All numbers in this memorandum are rounded to the nearest integer. Rates were calculated by taking the injury estimate or death count for that year and dividing by the Census population for children under five years of age for that year and multiplying by one million. Since NEISS is a weighted sample, injury category percentages were based on the category weighted estimate divided by the total weighted estimate. Death category percentages were based on the category count observed divided by the total count.

Injury estimates came from NEISS data extracted on April 2, 2007 for the time period 2004 to 2006. The NEISS product codes used for the data were 3251 (Built-in pools), 3221 (Above-ground pools), 1246 (Wading pools), and 1284 (Pools, not specified). Also, the age restriction was applied to extract data for children under five years only. Further screening of the NEISS data for submersions of children under the age of five produced additional incidents which mentioned pools in their narratives. NEISS data is a weighted sample and so all counts from this data were weighted as well. Since incidents in NEISS are unique, there were no duplicates.

This year's method of reporting empirical frequencies is consistent with the method used in the May 2006 memorandum. Prior to 2006, estimates were produced using capture recapture methods. However, analysis of the effect of changes in the ICD10 coding scheme supported use of empirical frequencies. Data was extracted on February 1, 2007 from NEISS, IPII, DTHS and INDP for pool-related submersion deaths involving children under five years old for the years 2002 to 2004. 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. Incidents are associated with product codes 3251 (Built-in pools), 3221 (Above-ground pools), 1246 (Wading pools), and 1284 (Pools, not specified). Information from these cases was extracted into an Excel spreadsheet and sorted by date and incident location. As pool

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<sup>10</sup> *Dorland's Illustrated Medical Dictionary*, 30<sup>th</sup> Edition, Saunders, 2003.

<sup>11</sup> "2006 Pool Drowning Memorandum," May 5, 2006.

submersion 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. Source documents were checked to eliminate duplicate incident reports. Once the incident set was established, the incidents were examined to code additional characteristics such as pool type, location, and scenario.