Pool Safety Anti-Entrapment Devices

Layers of Protection

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Purpose

The purpose of this report is to understand and assess the current need for Pool Safety Anti-Entrapment Devices, in particular, in the residential market.

The Issue

Beginning in the 1970s, the Consumer Product Safety Commission (CPSC) began investigating incidents of suction entrapment caused by the vacuum of a pool or spa drain. It is estimated that between 1999 and 2009 that there were 94 reported entrapments. Of the 94, there were 12 fatalities, 79 injuries and three incidents without injuries. The majority of these incidents happen to children between the ages of 5 and 14 (PoolSafely.gov). The most recent incident was a death of an adult man in a spa at a Hilton Sandals Resort in the Bahamas in January 2011 (Bahamas Local.com).

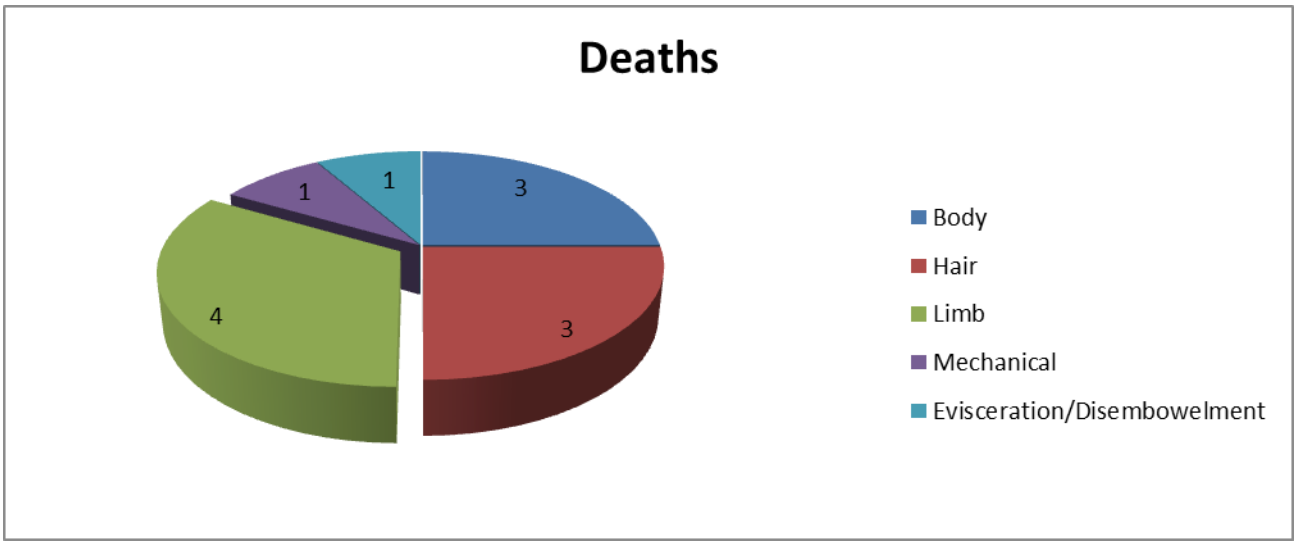
The ANSI/APSP-7 recognized five suction entrapment hazards caused by pool drains. They are:

The Five Types of Pool Drain Entrapment

1. Body Entrapment: A body part, often the torso or bottom, covers a drain and is held down by the intensity of the suction
2. Hair Entrapment: Long hair is caught in a faulty drain cover
3. Limb Entrapment: Arms, legs, feet or fingers are lodged in a suction opening
4. Mechanical Entrapment: Jewelry, bathing suits or other materials are entangled in a drain cover
5. Evisceration/disembowelment: When suction draws out the intestines and organs

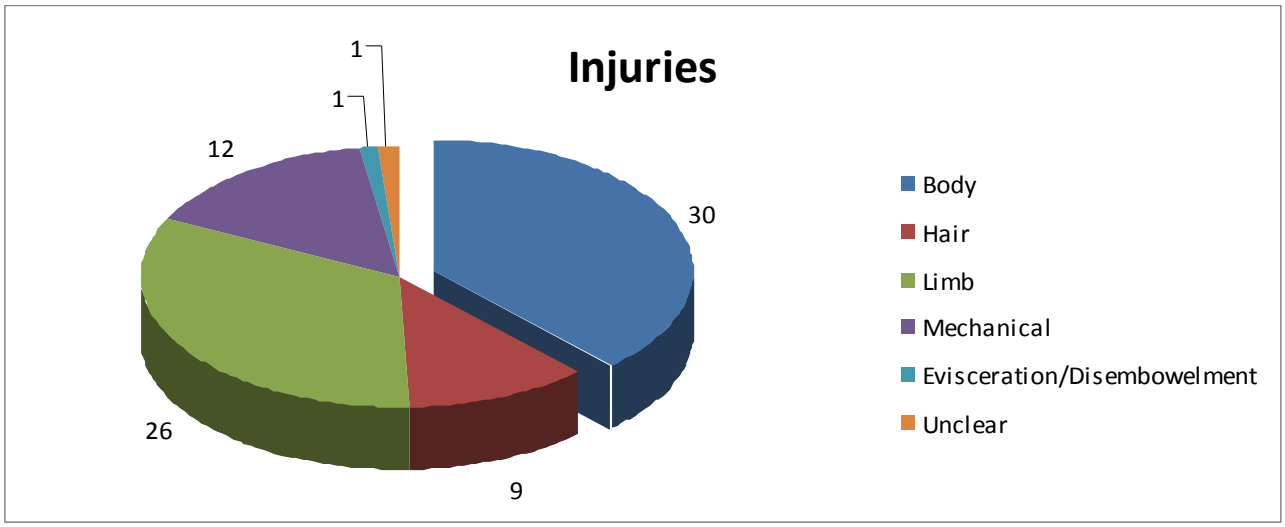
The Figure 1 diagrams the number of fatalities & injuries reported to the CPSC for circulation entrapments between 1999 and 2009:

Figure 1: Deaths by Entrapment Type from 1999-2009



*Data obtained from http://www.poolsafely.gov/wp-content/uploads/entrap10.pdf

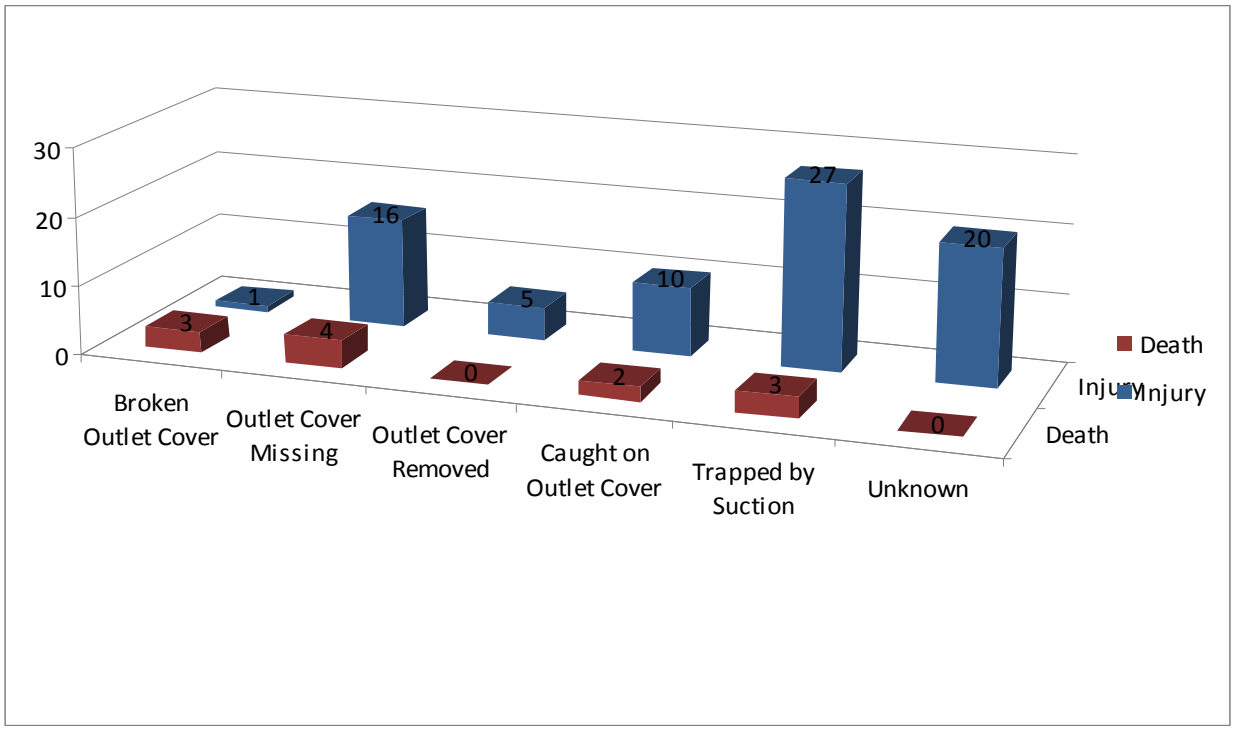
Figure 2: Injuries by Entrapment Type from 1999-2009



*Data obtained from http://www.poolsafely.gov/wp-content/uploads/entrap10.pdf

The following Figure diagrams the reason for entrapment and whether that resulted in a death or injury as reported to the CPSC, between 1999 and 2009:

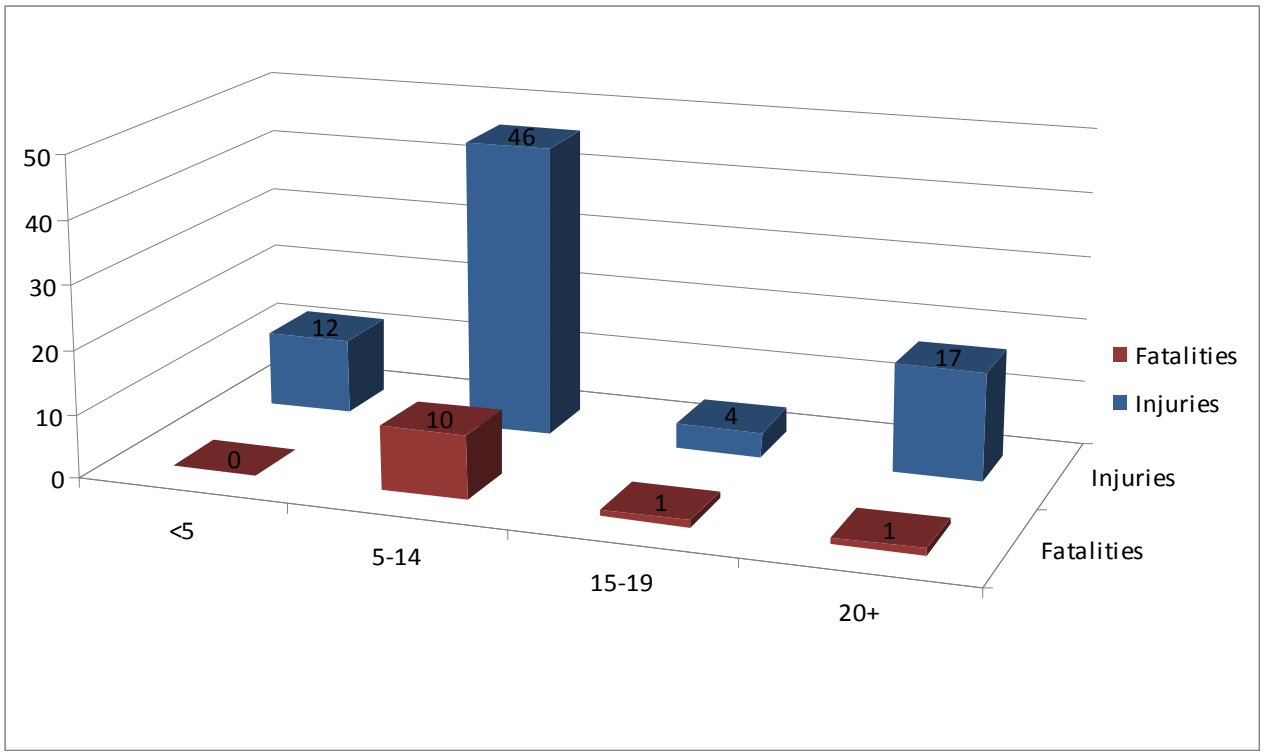
Figure 3: Reason for Entrapment and Result, 1999-2009



*Data obtained from http://www.poolsafely.gov/wp-content/uploads/entrap10.pdf

The following figure diagrams the age and number of fatalities & injuries reported to the CPSC for circulation entrapments between 1999 and 2009:

Figure 4: Fatalities and Injuries Reported to the CPSC for Entrapments by Victim Age Category, 1999-2009



* Data obtained from http://www.poolsafely.gov/wp-content/uploads/entrap10.pdf

This data suggests that the majority of deaths are by body, hair or limb entrapment to children ages 5-14 with an outlet cover that is missing or broken or they are trapped by suction. The majority of injuries are body or limb entrapment to children 5-14 who are trapped by suction.

Discrepancies

It is suggested that the number and type of suction entrapment incidents are vastly underreported. This is based on: (1) limited sampling of emergency medical reports by the CPSC and; (2) misdiagnosis or lack of entrapment as the cause of the incident or drowning. It is suggested that the majority of incidents are reported as a "pool accident" rather than "pool entrapment" and because of this are not able to be included as part of this data. The true number of pool entrapments and the type of entrapment is unknown.

Virginia Graeme Baker Pool & Spa Safety Act

The Virginia Graeme Baker Pool & Spa Safety Act (P&SS Act) takes its name from Virginia Graeme Baker, a young girl who drowned after she was trapped under water by the a broken hot tub drain. After her death, her mother, Nancy Baker, lobbied Congress to pass a law requiring anti-entrapment drain covers and other safety devices to prevent suction entrapment. The statute was signed into law in December 2007 (poolsafely.gov).

The following is the unauthorized, condensed version of the Virginia Graeme Baker Pool and Spa Safety Act (P&SS Act) as interpreted by the author of this report. It is simplified for the convenience and ease of the reader.

Overview

The Virginia Graeme Baker Pool and Spa Safety Act (P&SS Act) is a federally mandated law passed in 2007 that applies to pools and spas to protect against drowning and entrapment in pool drains. Section 1404 outlines the laws that apply to all pools and spas. States can implement their own laws on top of the federal laws, but they must meet the minimum requirements that are stated in Section 1406. Basically, the laws outlined in Section 1404 and 1406 are just minimum guidelines for individual States to make their own laws and one needs to reference their State law for the actual law and guidelines.

Section 1404 – Public Pools

Pool Drain Standard

Section 1404 of the P&SS Act states that all pool drains manufactured, distributed, or entered into commerce one year after the implementation of the law must conform to the entrapment protection standards of the ASME/ANSI A112.19.8 performance standard. This also means that any new *public or residential* pool being built or any *public or residential* pool receiving a new drain needs to have an anti-entrapment drain cover that meets ASME/ANSI A112.19.8.

Also under this section it states that all *public* pools and spas in the United States, new and old, must be equipped with an anti-entrapment drain cover that meets the ASME/ANSI A112.19.8 performance standard. Older *residential* pools (other than those receiving a new drain) do not unless their state specifically passed a law requiring residential pools to be retrofitted.

Single Drain Standard

Every *public* pool in the United States with a single main drain (other than an unblockable drain) shall be equipped at a minimum with 1 or more of the following devices or systems:

(i) Safety Vacuum Release System
(ii) Suction-limiting Vent System
(iii) Gravity Drainage System
(iv) Automatic Pump Shut-Off System
(v) Drain Disablement
(vi) Other systems determined by the Commission to be equally effective

Section 1406 – Minimum State Law Requirements

State Barrier Standard

Sec. 1406. of the P&SS Act states that all outdoor *residential* pools and spas must have a barrier that effectively prevents small children from gaining unsupervised access.

State Entrapment Standard

The P&SS Act states that “all pools and spas be equipped with devices and systems designed to prevent entrapment by pool or spa drains”. It is up to each State to determine which devices and systems.

State Single Main Drain Standard

Pools and spas built more than 1 year after the date of the enactment of such statute should have:

(I) more than 1 drain;
(II) 1 or more unblockable drains; or
(III) No main drain

State Pool and Spa Drain Standard

Every pool and spa that has a main drain (other than an unblockable drain), be equipped with a drain cover that meets the standards of the ASME/ANSI A112.19.8 performance standard.

Individual State Laws

As mentioned previously, States can implement variations of the Federal Law as long as they meet the minimum state law requirements. Florida for example has only approved the use of a gravity drainage system as a viable device for pools with a single main drain (although it should be noted that they are currently reconsidering allowing other alternatives such as an SVRS due to the extreme cost involved in installing a gravity drainage system).

The majority of states only require *public* pools and spas to have an anti-entrapment safety device/system, but more and more states such as Connecticut are starting to also require *residential* pools and spas to have one as well.

Anti-Entrapment Devices/Systems

As mentioned above, there are five (5) federally approved devices/systems to prevent anti-entrapment. The different devices and described and compared below:

Figure 5: Anti-Entrapment Devices/Systems

Device	Description
Safety Vacuum Release System (SVRS)	Ceases operation of the pump, reverses the circulation flow or otherwise provides a vacuum release at a suction outlet when a blockage is detected
Suction Limiting Vent System	Also called an atmospheric vent is a pipe teed to the suction side of the circulation system on one end and open to the atmosphere on the opposite end. When a blockage occurs at the main drain, air is introduced into the suction line causing the pump to lose prime and relieving the suction forces at the main drain.
Gravity Drainage System	uses a collector tank and has a separate water storage vessel from which the pool circulation pump draws water. Water moves from the pool to the collector tank depending on atmospheric pressure, gravity and the displacement of water by bathers, which removes the need for direct suction at the pool. This type of system is also referred to as a reservoir, surge tank or surge pit.
Automatic Pump Shut Off System	a device that would sense a drain blockage and automatically shut off the pump system. Most SVRSs fall into this category as well.
Drain Disablement	the only option that eliminates rather than mitigates the hazard. To satisfy the definition of drain disablement, the drain/outlet would need to be physically removed from the system by filling the sump with concrete, cutting and capping the piping in the equipment room or re-plumbing the section line to create a return line and reverse flow.

*Data obtained from poolsafely.gov

Of the above options, the most cost effective and easiest device/system to install is the SVRS which can be generally installed in less than 30 minutes and ranges in price from $350 to $1500.

What is an SVRS?

A Safety Vacuum Release System (SVRS) is a device that ceases the operation of the pump, reverses the circulation flow or otherwise provides a vacuum release at a suction outlet when a blockage is detected.

SVRSs help to prevent against 1 of the 5 types of pool drain entrapment: body entrapment. Some SVRSs claim they also prevent against limb entrapment due to the quick response time, which would release the limb before it had time to swell and get stuck in the pipe. The exception to this are if the limb gets pulled around a 45 degree angle or coupling and then becomes mechanically entrapped.

Layers of Protection

In addition to an SVRS or other federally-approved anti-entrapment device, there are several other devices that can be installed in and around and pool to prevent entrapment. These include anti-entrapment drain covers, pool barriers, alarms, power safety pool covers, and emergency stop buttons. Some of these are required and mandated by law and others are up to the discretion of the pool owner. However, the more layers of protection, the less likely there is to be an accident or death. It should be noted that even shallow pools and spas are a danger. Studies have shown that more injuries or death occurs as the proximity of the drain is closer to a child's play area. Virginia Graeme Baker died in a residential spa after one of her friends pulled her in and she became entrapped on a broken drain.

Anti-Entrapment Drain Covers

Pool drains have tremendous suction: a typical 8-inch pool drain can have a suction of over 350 pounds of pressure for a standard pump (poolspanews.com). This extreme pressure is the reason a full grown adult can become entrapped on a pool drain and still drown; such as the case in January 2011 when a man died at the Sandals Bahamas resort after becoming entrapped on a spa drain (poolspanews.com). When a drain cover is flat, any object or body part that covers that drain can become entrapped by the powerful suction. If the drain is broken or missing, the danger is even more prevalent where even limbs can be sucked into the drain pipe.

Anti-entrapment drain covers are either domed or shaped in a way that prevents bodies or objects from creating a seal over the cover. Because of the P&SS Act, all public and residential pools and spas *must* have an anti-entrapment drain cover that conforms to ASME/ANSI Standards and to the specifications in ASTM F 1346-91. The U.S. Consumer Product Safety Commission (CPSC) maintains a list of all approved drain covers.

On May 26th, 2011 the CPSC announced a recall of pool safety drain covers from 8 manufacturers. The investigation revealed that the testing protocols used by some laboratories may have been improper, resulting in unsafe drain covers that could lead to pool drain entrapment (CPSC.gov). One of the only anti-entrapment drain cover manufacturers not recalled by the CPSC is Drainsafe who makes the DS360, DS360M, and DS360MA.

Pool Barriers

The P&SS Act requires that all pool and spas have an approved barrier surrounding the pool to prevent small children access. Each state has its own regulations but generally it consists of a barrier that is at least 48 inches above the ground with openings in the barrier not to exceed 4 inches and openings in a chain fence not to exceed 1 ¾ inches square.

In addition, gates to access the pool should open outward away from the pool and should be self-closing and self-latching. Gates also need to have a locking device that is at least 54 inches from the bottom of the gate; or if it is less than 54 inches, it needs to be located on the pool side of the gate at least 3 inches below the top of the gate with the barrier no wider than ½ within 18 inches of the release mechanism.

While these are not completely childproof, they are a deterrent and provide another layer of protection around a pool or spa.

Alarms

There are several types of pool alarms:

Pool Entryway Alarms: Alarms that sound when doors or windows with direct access to the pool are opened.

Surface Wave Sensors: This type of sensor floats on the water and incorporates an electrical circuit that includes two contacts. One of these contacts rests in the water while the other is adjusted to remain above the water's surface. When a surface wave touches the above-surface contact, the electrical circuit is completed, causing an alarm to sound. Sensitivity can be increased or decreased by moving the above-surface contact closer or further from the water surface.

Sub-Surface Disturbance Sensors: These sensors are mounted to the pool wall below the water surface, this type of sensors is activated by wave-induced pressure changes. One design relies on the movement of a magnetic float below a magnetic sensor, while another design relies on a pressure-sensitive switch. Sub-surface alarms can also be used in conjunction with solar covers, whereas the surface wave-sensor alarms cannot.

Wristband Alarms: This device is worn around the child's wrist and it cannot be removed without a key. The alarm will activate when the wristband becomes wet, which creates opportunities for false alarms, such as when the child washes his or her hands, or walks in the rain (reyesinspections.com).

Again, while these are not childproof and will not prevent against entrapment while swimming, the alarm may mean the difference between life and death in the case of a child who is temporarily unsupervised. Individual States and even some Counties have their own regulations when it comes to which alarms, if any, are required by law.

Power Safety Pool Covers

Power safety pool covers can be used as an alternative to alarms (or in addition to as another layer of protection). A power safety pool cover is a motor powered barrier that can be placed over the

water area. The motor-driven cover easily opens and closes over the pool providing a high level of safety for small children (liveandlearn.com).

While these are excellent for preventing unauthorized access to a pool, they do not prevent against entrapment while the pool is in use and they can be extremely expensive.

Emergency Stop Button

A pool emergency stop button shut off the pool pump in case of emergencies, such as with an entrapment. These are typically installed near the pool or spa so it can easily be reached by a pool attendant.

Websites

Below is a list of several websites that are relevant to pool entrapment:

Government/Associations
Pool Safely
CPSC
APSP
IPSSA

Organizations
NDPA
Abbeys Hope
Safe Kids USA
Piscinasegura
Santi Rivera Foundation

News/Videos
SVRS
The Five Types of Entrapment
Pool Safety Council Studies Raise Entrapment Questions
Confidential Study Warns of Serious Injury of Death from Drain Covers Used In Millions of US Pools
Is Your Pool's Drain Safe? (ABC)
She Died In My Arms: A Mother's Mission for Safe Pools
More Than 1,000 Public Pools Fail To Comply With Safety Laws
Attorneys Show Video of Faulty Drain at Hotel
Girl Injured by Pool Drain Testifies in Law Suit
Man Found Dead in Hot Tub At Sandals
ABC Special Segment: Deep Trouble
NBC Today Show – Banned Drain Covers Still Used in Public Pools
A Dangerous Gap in Pool Safety
Wife of Man Who Drowned at Athletic Club Files Wrongful Death Suit
Family Warns of Pool Dangers After Girl Dies
Swimming Pool Suction Entrapment Education - IPSSA
Pool Company President Takes Blame for Connecticut Boy's Drowning