TOPIC: Aquatic Entrapment Guidelines – Pools and Spas

UPDATE: Since the drafting of this article, the Virginia Graeme Baker Pool and Spa Safety Act has become federal law. Although the terms of this law govern, the information below is still a useful reference to steps that can be taken to address entrapment hazards in conjunction with the requirements of the law. For more information on the Virginia Graeme Baker act requirements, see RMT: Virginia Graeme Baker Act Resources and http://www.poolsafety.gov/state-local-officials/pool-spa-safety-act-requirements/.

The National Spa and Pool Institute and the American National Standards Institute have drafted a consensus standard to address the risk of entrapment in pools and spas. This standard applies to both new construction and existing facilities.

The nearly 150 documented entrapment incidents in pools and spas over the last 20 years have resulted in 36 deaths. These figures almost certainly understate the problem, however – experts believe that many cases of entrapment are classified solely as a near drowning or not against the drain by the suction of the circulation pump, but also can change in pressure is sufficient to cause such injury extremely quickly. If a child's buttocks cover the drain opening, the resulting suction or they can also be caught in a drain much as hair is and cause entrapment. Scenarios involving clothing and jewelry are, however, relatively rare.

Evisceration / Disembowelment

The typical disembowelment scenario involves a young child, two to six years old, who sits on an uncovered drain in a public wading pool. Young children have access to the bottom drain in wading pools because of the shallow water. Drains are normally equipped with anti-vortex covers whose dome-shape prevents sealing of the pipe opening by the body. However, if the cover or grate is unfastened, broken, or missing, the potential for an incident exists. If a child's buttocks cover the drain opening, the resulting suction force can rupture the rectum and eviscerate the child. A small change in pressure is sufficient to cause such injury extremely quickly.

All pools and spas are required by the new standard to employ the following in order to prevent entrapment:

1. All suction outlet covers/grates (main drain covers) that are fully submerged shall be listed by a nationally recognized testing laboratory. Any covers or grates that are built site specific must be certified by a professional engineer to conform to the same standards as the nationally recognized covers or grates. The maximum system flow may not exceed the rating on any single suction outlet cover/grate.

2. If a safety vacuum release system (SVRS) is used it must be tested and listed. A venting SVRS device is permitted if it is between the check valve and the main drains, but is not permitted between the check valve and the pump. A non-venting SVRS device is not permitted if your pool incorporates a check valve.

3. A custom engineered vent system must be designed and certified by a professional engineer to relieve a vacuum at the drain to become the sole inlet to the pump and becomes dangerous when there is an inadequate or missing drain cover.

Hair or Mechanical Entrapment / Entanglement

The U.S. Consumer Product Safety Commission cites 30 spa and hot tub incidents since 1990 in which long hair became entangled in the drain grates – ten of which resulted in drowning deaths. These incidents typically involve females with long, fine hair who are underwater with their head near a suction inlet. The water flow into the inlet draws the hair into the inlet and the hair becomes entangled in and around protrusions and holes of the cover. Entrapment occurs because of the entanglement, not necessarily because of strong suction forces. These cases most frequently occur in spas or hot tubs. Clothing or jewelry may become entangled in loose or inappropriate ladders and similar equipment, or they can also be caught in a drain much as hair is and cause entrapment. Scenarios involving clothing and jewelry are, however, relatively rare.

There are five types of suction entrapment

- body entrapment: section of the torso becomes entrapped
- limb entrapment: an arm or leg is caught by or pulled into an open drainpipe
- hair entrapment: hair is pulled into or wrapped around the grate of the drain cover
- mechanical entrapment: the bather’s jewelry or clothing gets caught in the drain or the grate
- evisceration: the victim’s buttocks come into contact with the pool suction outlet and he or she is disemboweled

Body Entrapment / Limb Entrapment

These deaths or injuries primarily occur when the body or a limb is held against the drain by the suction of the circulation pump, but also can occur if a child gets a hand or foot caught between a ladder and the pool wall or in some other restricted space. Such incidents primarily involve children from eight to sixteen years old with the average age being ten. In some of the cases the child may have been playing with the open drain, e.g., inserting a hand or foot into the pipe, and then became trapped by the resulting suction. From 1999 to 2010, 35% of the reported entrapment cases were due to body entrapment. Many different design and maintenance circumstances can potentially produce entrapment conditions in pools and spas. The range of historic scenarios suggest that this hazard exists whenever two conditions coexist: 1 – there is an open drain or a flat grating that can be completely covered by a body part; 2 – there is a plumbing configuration that allows a suction buildup if the drain is blocked. This poses a serious problem if the configuration allows a single bottom

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outlet within 3 seconds after the covers are blocked.

4. Skimmers and overflows (gutters) shall be vented to the atmosphere or incorporate an equalizer line. Any equalizer line must be protected by an approved cover or grate.

5. Multiple pumps may draw water from a common sump provided that the total flow from the pumps does not exceed an individual main drain cover or grate rating. The water velocity in the sump and connecting piping cannot exceed six feet per second.

Newly constructed pools and spas must utilize one of the following ways of reducing entrapment potential:

1. **Main drains are not required:** The surface skimmer or overflow/gutter system may draw 100% of the system outlet flow.

2. **Gutter/Overflow System:** The perimeter/gutter overflow system draws water through a gravity flow to a remote collector tank that is not bather accessible.

3. **Dual drains:** A minimum of 2 listed/approved covers/grates are provided for each pump in the suction outlet system. These drains must be at least 3 feet apart measured from the center or on different planes (wall and floor) and must simultaneously draw water through a common line. Each suction outlet fitting must be rated for the maximum system flow.

4. **Channel drain system:** One or more channel grates are permitted provided they are 3 inches or greater in width and 31 inches or greater in length and fastened to prevent removal.

5. **Custom designed suction outlet fittings:** Any custom designs must be approved by a licensed professional engineer.

6. **Gravity fed system:** Systems that use gravity flow through one or more listed/approved covers/grates into a collection tank must be vented to the atmosphere. If the collector tank is bather accessible (as in a vanishing edge pool) the collection tank must be protected by an approved cover or grate and it is plumbed through a skimmer that is manufactured to permanently prevent the installation of a balance valve.

7. **Venturi Debris Removal System:** These systems are acceptable through a single floor mount suction outlet provided they have a listed/approved cover/grate.

8. **Other Means:** Any alternative configuration, design, or system may be used provided the alternative meets the intent of the standard and is approved by a certified engineer.

Existing pools or spas must meet the following:

1. Any pool that is to be retrofit as new must be in accordance with any of the options in the Newly constructed pools and spa section.

2. When a full retrofit is not feasible, the following corrective actions shall be taken to minimize the risk of entrapment:

3. **Establish the maximum system flow through either a direct measurement test or through calculation. Install higher rated covers that exceed the determined flow or change to a lower flow pump.**

4. Existing installations with a single main drain that have an approved cover or grate must add at least one of the following:

5. **Gravity flow system**
   - additional listed/approved outlet(s)
   - a certified vent system
   - a safety vacuum release system (SVRS)

6. A single main drain or equalizer line is acceptable providing it is protected by an approved cover or grate and it is plumbed through a skimmer that is manufactured to permanently prevent the installation of a balance valve.

7. An installation with multiple approved covers or grates where at least one is located more than 24” below the normal operating water level require no corrective action.

8. An installation with multiple listed/approved covers/grates located 24” or less below the water line (zero-entry or shallow water pools) shall add at least one of the following:

9. **Additional listed/approved covers/grates (total of 3 or more)**
   - a safety vacuum release system (SVRS)
   - a certified vent system
   - a gravity flow system

**Wading pools** should meet the following requirement because their shallow water levels may increase the hazard of suction evisceration.

The wading pool must have dual main drains with approved covers or grates and at least one of the following:

- additional listed/approved covers/grates (total 3 or more)
- a certified vent system
- a safety vacuum release system (SVRS)
- a channel drain system
- a gutter or 100% overflow system
- a gravity flow system

The presence of all the necessary construction to reduce the risk of entrapment does not completely prevent the possibility of entanglement or other accidents.
• **Children in a pool, spa, or hot tub should be directly supervised by an adult at all times;** they should never be left alone and they should not be permitted to submerge their heads in spas or hot tubs without immediate supervision.

• **Children under 6 should not be allowed in spas or hot tubs** except with written direction and authorization from a consulting physician.

• **Nobody should be in the water without someone else monitoring their activity:** even lifeguards and pool maintenance personnel must stringently follow this rule such liberties have cost many individuals their lives.

Keep your pools and spas safe...make certain that users are not exposed to the dangers of entrapment.

**Please call us at 800-463-8546 to discuss this or any other risk management safety tip, or visit our web site at www.redwoodsgroup.com to learn more about YMCA risk management issues.**