

2018 Annex to the Model Aquatic Health Code

Scientific Rationale

Mini-MAHC: Improving Swimmer Hygiene and Diaper-Changing



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

Extracted from the 2018 MAHC

CS295591-A

Mini-MAHC Annex

Improving Swimmer Hygiene and Diaper-Changing

CDC's Model Aquatic Health Code (MAHC) consists of two guidance documents:

1. Code Language (3rd Edition, 2018)
2. Annex/ Rationale (3rd Edition, 2018)

Purpose:

Specific public health issues addressed in the MAHC are often spread across multiple chapters. Mini-MAHCs are intended to make the MAHC more user friendly by consolidating the code and annex language addressing a specific public health issue into a concise document. This will help environmental health practitioners and pool operators quickly find relevant MAHC recommendations and rationale so they can use the information to promote patron and staff health and safety.

This Mini-MAHC focuses on improving swimmer hygiene and diaper-changing practices to decrease water and surface contamination. This Mini-MAHC

- Addresses use of cleansing showers, poolside rinse showers and diaper-changing stations to reduce contamination.
- Promotes expanding swimmer education on hygienic practices and behaviors.
- Emphasizes limiting the walking distance to hygiene facilities to encourage use.

Although common health and safety elements such as garbage receptacles, drinking fountains, water supply, and sanitation are important for good public health, they are not discussed in this document. The full 2018 MAHC Code Language and Annex offers additional health and safety recommendations.

Although chlorine and other disinfectants are an effective way to kill germs found in recreational water, they do not work instantly. Despite the use of disinfectants, treated recreational water-associated outbreaks continue to occur and affect thousands each year. Free chlorine oxidizes nitrogen-containing compounds from swimmers (e.g., sweat, urine, and personal care products) to form chloramines, which volatilize from the water and into the air and can cause eye and respiratory irritation. High chloramine production in indoor aquatic venues has been linked to outbreaks of eye and respiratory irritation. Improving swimmer hygiene through showering, improved diaper-changing practices, and education should improve pool water quality and reduce the incidence of outbreaks. We all share the water we swim in, so each of us needs to do our part to help keep our families, our friends and ourselves healthy.

IMPORTANT

Unless otherwise noted,

- Provisions in Chapter 4 (Aquatic Facility Design Standards and Construction) apply only to new construction or substantial alteration to an existing aquatic facility or venue.
- Provisions in Chapter 5 (Operation & Maintenance) apply to all aquatic facilities covered by the MAHC regardless of when constructed.
- Provisions in Chapter 6 (Policies & Management) apply to all aquatic facilities covered by the MAHC regardless of when constructed.

Citations were removed to condense the Mini-MAHCs. A list of references are in the complete version of the 2018 MAHC Annex (3rd Edition).

^A = denotes where information is further supplemented in the MAHC Annex (Rationale).

4.0 Design Standards and Construction

4.10 Hygiene Facilities

4.10.1 General

Language similar to this section is found in most state CODES.

4.10.1.2 Minimum to Provide

During 2011–2012, 36 (81.8%) of 44 treated recreational water–associated outbreaks of diarrheal illness were caused by *Cryptosporidium*. These cryptosporidiosis outbreaks tend to disproportionately affect children under 5 years of age and can cause community-wide outbreaks. Infectious *Cryptosporidium* OOCYSTS' extreme CHLORINE tolerance allows them to survive for 2.4–10.6 days when FREE CHLORINE levels are maintained at 1–3 mg/L. The OOCYSTS small size (4.5 μm x 5.5 μm) also allows them to bypass typical sand and cartridge filters. While SECONDARY DISINFECTION SYSTEMS or SUPPLEMENTAL TREATMENT SYSTEMS can inactivate the OOCYSTS, these UV and ozone treatment systems are circulation dependent so can require extended times for inactivation of pathogens in the POOL. Thus, changing BATHER behavior in the following ways are needed to help prevent cryptosporidiosis outbreaks:

- Enforcement of policies that exclude swimmers with diarrhea,
- Swimmer education about hygienic swimming behaviors (*e.g., taking a CLEANSING SHOWER before entering the water, not swallowing the water*).

Chloramines

During January–March 2007, over 660 BATHERS and aquatic staff at a waterpark experienced respiratory symptoms and eye irritation caused by chloramines. Chloramines form when FREE CHLORINE OXIDIZES nitrogenous compounds (*e.g., sweat, urine, and personal care products*) that wash off BATHERS' bodies. Chloramines can volatilize into the air where it can accumulate in air of indoor AQUATIC VENUES. One in five (17%) American adults reports having ever urinated in a POOL, and elite athletes can sweat over 700 mL/h. Rinsing off in the SHOWER for 60 seconds and wearing bathing caps significantly decreases the amount of total organic carbon and total nitrogen. Studies also suggest that UV treatment can reduce chloramine levels in the water. Accumulation of chloramines in the air at indoor treated recreational WATER VENUES can be reduced with the following practices:

- Policies that require SHOWERING before entering the water,
- Swimmer education about hygienic swimming behaviors (*e.g., taking a RINSE SHOWER and using the toilet before entering the water, not urinating in the POOL, and wearing bathing caps*), and
- Using UV water treatment
- Improving ventilation.

4.10.1.5 Theoretical Peak Occupancy

The minimum number of RINSE SHOWERS and CLEANSING SHOWERS should have PLUMBING FIXTURE counts correlated directly to the THEORETICAL PEAK OCCUPANCY IN MAHC 4.1.2.3.5. Any PLUMBING FIXTURE counts above this should be accordance with the AHJ's requirements.

4.10.2 Location

4.10.2.1 Distance

The intent of this CODE item is to discourage PATRONS from drinking POOL water and encourage them to keep themselves hydrated. The intent is also to encourage PATRONS to use the HYGIENE FACILITIES rather than urinating in the POOL or changing diapers at the side of the AQUATIC VENUE or on AQUATIC VENUE furniture. Restrooms need to be easily accessible and available to PATRONS of AQUATIC VENUES so that they will use restrooms rather than urinating or defecating in the VENUE water, which is common. Compared with other public locations, people feel that it is more acceptable to “pee in the POOL” and not use sanitary facilities for this bodily function. This may not be possible in large waterparks, however, they can possibly be located within 300 feet (91 m) from the AQUATIC VENUE. The distance needed for parents to walk or carry children less than 5 years of age

should be shorter (*200 ft or 61 m*) to ensure use. These distances are found in multiple state or local CODES including Wisconsin, Oregon, Florida, and New York. When possible, it is preferable to have a bathroom on the same floor as the AQUATIC VENUE; however, it is not required at this time in the MAHC. Drinking water should be available so that PATRONS, especially young children, are less likely to drink POOL water and to ensure that PATRONS are kept well-hydrated.

4.10.2.2 Children Less than Five Years of Age

There are specific types of AQUATIC VENUES that pose an INCREASED RISK of fecal contamination of the water and transmission to BATHERS such as WADING POOLS, WATER ACTIVITY POOLS, INTERACTIVE WATER PLAY VENUES, or other AQUATIC VENUES designed primarily for children less than 5 years of age. For these AQUATIC VENUES, diaper changing areas should be located directly adjacent to the kiddie areas to promote use. It is especially important that HYGIENE FACILITIES be available to these INCREASED RISK groups. Children less than 5 years of age have the highest incidence of diarrheal illness and are more likely to be a source for spreading Recreational Water-Associated Illness Outbreaks and Injuries (RWI).

4.10.3 Design and Construction

Language similar to this section is found in most state CODES.

4.10.3.2 Floor Base

The purpose of coving is to prevent water splashing on the wall when mopping. Six inches (*15.2 cm*), a common height, was taken from building CODE.

- For further information, also see the FDA Food Code for Kitchens.

4.10.3.3 Floor Drains

4.10.3.3.1 Opening Grill Covers

Holes in floor drain cover openings need to be sized to prevent small children's toes from becoming entrapped when walking over them.

4.10.3.3.2 Sloped to Drain

Floors not sloped to drain have been shown to allow bacterial growth on indoor and outdoor AQUATIC VENUE POOL DECKS.

4.10.3.5 Hose Bibb

The purpose of these hose bibs is to permit adequate cleaning of SHOWER and toilet facilities and to permit cleaning of any spills occurring in the HYGIENE FACILITY. See also MAHC 6.5 for further rationale.

4.10.4 Plumbing Fixture Requirements

Language similar to this section is found in most state CODES.

4.10.4.1 General

4.10.4.1.1 Protected

It is fundamental that there be no CROSS-CONNECTIONS between safe (*potable*) and unsafe (*non-potable*) water supplies. All hose bibbs should be equipped with a vacuum breaker to prevent back siphonage. This CROSS-CONNECTION protection can also be achieved at lavatories and laundry tub washing facilities through an air gap. As a general rule, the INLET pipe is terminated at a distance about four times the diameter of the pipe and not less than 4 inches (*10.2 cm*) above the maximum overflow level of the PLUMBING FIXTURE rim.

4.10.4.1.3 Toilet Counts

Facilities in jurisdictions with requirements governing the number of sanitary facilities should follow those requirements. AQUATIC FACILITIES with an average PATRON load of over 100 persons should follow the IPC. Facilities with average PATRON loads of less than 100 persons should follow either the IPC or UPC. The IPC may require significantly more toilet facilities for women than for men.

Potty Parity

(Abstracted from ICBO adoption materials) Previous issues of the nation's model consensus CODE mandated an equal amount of toilet FIXTURES for both men and women. Newer versions of the CODE will likely provide recommendations that increase the minimum required facilities for women. The IPC requires far less HYGIENE FIXTURES for various types of occupancies than the UPC. This is contrary to the "potty parity" movement which demands more FIXTURES for women's toilet rooms to avoid the long waiting lines. The UPC also provides more WCs and urinals in most men's toilet rooms than the IPC and assures adequate WCs by limiting the number that can be deleted by installing additional urinals. The authors of the ICBO have suggested that the provisions of the UPC reflect what the "potty parity movement" called for. The provisions of the IPC do address the issue of "potty parity". The issue of "potty parity" is mostly an issue in assembly buildings with large occupant loads, especially where there is a period of high demand such as at intermission at a theater or at halftime at a football stadium. "Potty parity" is not an issue for occupancies where there is no instantaneous demand on the FIXTURE usage. IPC Table 403.1 reflects requirements for twice as many PLUMBING FIXTURES in the ladies' room compared with the men's room, when the type of occupancy demands such a count. In occupancies where the factors do not demand such an increase, the CODE does not require it. It should also be pointed out that part of this issue arises because of some CODES requiring both WCs and urinals within the men's restroom. Therefore, the numbers for men were somewhat higher. The IPC does not have a mandatory requirement for urinals. It will generally require the same number of PLUMBING FIXTURE in the men's and women's restrooms. However, when two or more WCs are required, the IPC will permit up to 67 percent of the FIXTURES to be replaced by urinals.

Some differences between the IPC and UPC CODES on this issue are as follows:

International Plumbing Code:

- Utilizes a fixed PLUMBING FIXTURE to OCCUPANT LOAD ratio.
- Does not mandate urinals for men.
- Allows up to 67% of the requirement for WCs to be substituted for urinals.
- Establishes a separate FIXTURE calculation factor for men and women. In some cases twice as many FIXTURES are required for women compared with men.
- No arbitrary parity requirement.

Universal Plumbing Code:

- Utilizes a variable PLUMBING FIXTURE to OCCUPANT LOAD ratio.
- Requires urinals to be installed based on a FIXTURE to OCCUPANT LOAD ratio. Does not allow for one to one substitutions. For each urinal added over what is required, you may have one to one substitutions up to 2/3 of what is required.
- Requires the total number of WCs for women to be equal to the total number of WCs and urinals for men.

4.10.4.2 Cleansing Showers

The purpose of CLEANSING SHOWERS described in this section is to remove dead skin, sweat, nitrogenous waste, and perianal fecal material before BATHERS enter the POOL. This is best done through nude SHOWERING using warm water and soap. An average of 0.14 grams of fecal material can be found on a person's peri-anal surface (*the amount of feces for children ranges from 0.01-10 grams and for adults 0.0001 to 0.1 g*). Therefore, fecal contamination of the perianal area is common. This contamination may include the CHLORINE-tolerant parasite *Cryptosporidium* which is not inactivated by routine DISINFECTANT levels required in AQUATIC VENUES. Since the effectiveness of most halogen-based DISINFECTANTS is reduced by the presence of organic material, the purpose of CLEANSING SHOWERS is to reduce the inorganic, organic, and fecal load introduced into POOLS.

4.10.4.2.1 Count

The THEORETICAL PEAK OCCUPANCY (MAHC 4.1.2.3.5) has been accounted for in the one SHOWER per sex per 4000 square feet ($372 m^2$). This assumes using one BATHER per 20 square feet ($1.9 m^2$), so at 4000 square feet, there will be one SHOWER per 200 BATHERS. Further research on this topic is recommended and can be addressed in future versions of the MAHC.

4.10.4.2.3 Location

The placement of the SHOWERS is intended to encourage BATHERS to see and use the SHOWERS before they enter the water.

4.10.4.2.4 Enclosed

Entryways to CLEANSING SHOWER compartments shall be enclosed to provide privacy. Individual SHOWER stall curtains and doors are not required. Providing privacy for CLEANSING SHOWERS promotes BATHER cleansing prior to entering AQUATIC VENUES.

4.10.4.2.6 Exemption

“Residential settings” includes condos, apartments, and homeowners associations but does not apply to individual residential POOL settings. The intent is for BATHERS to use their rooms/homes for a CLEANSING SHOWER; however, one RINSE SHOWER on the DECK is required at these AQUATIC FACILITIES encouraging BATHERS to SHOWER prior to entering water if a BATHER had not already done so.

4.10.4.3 Rinse Showers

The purpose of the RINSE SHOWERS is to remove inorganic material such as sand or dirt that can bind with CHLORINE and reduce the amount for other pathogen inactivation. Rinsing with water also removes BATHER’S CONTAMINANTS such as sweat, hygiene products, deodorant, hair spray, etc. Rinsing off in the SHOWER for 60 seconds and wearing bathing caps significantly decreases the amount of total organic carbon and total nitrogen. A RINSE SHOWER can be taken on the DECK in open SHOWERS by the AQUATIC VENUE using ambient temperature water so dirt and other CONTAMINANTS are rinsed off before entering the water.

4.10.4.3.3 Floor Sloped

Floors of RINSE SHOWERS shall be sloped to drain waste water away from the AQUATIC VENUE and any landscaping areas if present. The intent is to prevent landscaping materials from being tracked back or washed into the AQUATIC VENUE area.

4.10.4.3.4 Large Aquatic Facilities

The intent is to encourage BATHERS to see and use the RINSE SHOWERS before they enter the water.

4.10.4.3.5 Beach Entry

The intent of having at least four showerheads every 50 feet (15.2 m) at a beach entry allows multiple people to rinse off at the same time. Showerheads could be provided as wall units, pedestals (*one pedestal could have four showerheads or two pedestals could have two showerheads each*), allowing AQUATIC FACILITY owners to have versatility in design.

4.10.4.3.6 Lazy River

BATHERS enter LAZY RIVERS only in designated areas; therefore locating RINSE SHOWERS near these entrances facilitates rinsing before entering the LAZY RIVER.

4.10.4.3.7 Waterslide

BATHERS congregate into queue lines for access to WATERSLIDES. Providing a RINSE SHOWER on the DECK of a queue line encourages use prior to entering the water.

4.10.4.4 All Showers

The intent is to encourage use of SHOWERING prior to entering an AQUATIC VENUE. Large AQUATIC FACILITIES, based on their THEORETICAL PEAK OCCUPANCY, would require a large number of CLEANSING SHOWERS which would put an economic burden on these facility types. The MAHC acknowledges CLEANSING SHOWERS are more expensive to install than RINSE SHOWERS, therefore as long as the required number of SHOWERS is met, AQUATIC FACILITIES can decide which type of SHOWER is conducive for their PATRONS. In addition, the ISPSC Section 609.3.1 allows flexibility on the ratio of CLEANSING to RINSE SHOWERS above 7,500 square feet of water surface area.

4.10.4.5 Diaper-Changing Stations

The material in this section addresses diapering of infants and young children. These are the age groups most commonly involved in contamination of recreational water that can lead to outbreaks of illness associated with recreational water. Although some older persons must wear diapers the incontinence is less likely to be associated with a diarrheal illness so the risk of infection from adults is much less than that from children. Therefore, we do not believe that special regulations are needed for elderly BATHERS. Current DIAPER-CHANGING UNIT designs do not supply all the features needed for sanitary and efficient diaper changing and clean-up to minimize spreading pathogens further in the AQUATIC FACILITY.

The MAHC defines a DIAPER-CHANGING STATION to include the following:

- A DIAPER-CHANGING UNIT,
- An adjacent hand washing sink,
- Soap with dispenser,
- Trash receptacle, and
- Necessary cleaning materials for the DIAPER-CHANGING UNIT.

4.10.4.5.1 Each Facility

4.10.4.5.1.1 Hand Wash Sink

HAND WASH STATIONS are required adjacent to DIAPER-CHANGING STATIONS to promote use after using the toilet/urinal or changing diapers. Facilities will have 1 year after adoption on this MAHC section to install a plumbed sink with soap and dispenser, hand drying device/or paper towels and dispenser, and trash receptacle.

4.10.4.5.1.2 Portable

If a permanently plumbed hand wash sink is not economically feasible to install, a portable HAND WASH STATION can be used as a substitute for 1 year. Portable HAND WASH STATIONS are used at temporary events and include a water and waste tank that requires frequent refilling and draining for continual use.

4.10.4.5.2 Conform

There appear to be two different configurations of DIAPER-CHANGING UNITS currently available and suitable for this setting. The first type, a fold-down commercial unit commonly mounted on the wall, is addressed by ASTM F2285-04. The second type, a free-standing unit, is addressed by *Caring for Our Children (CFOC)*. A major difference between these two designs is that ASTM F2285 calls for restraining straps while CFOC prohibits the use of straps and relies on a 3 inch (7.6 cm) lip to keep children from falling off. Both designs have inherent problems. The problems with straps are associated with cleaning and possible hanging hazard. The problem with a 3 inch (7.6 cm) lip is that they are not available on fold-up units. The MAHC language does not discriminate between these two designs, but the unit used should conform to one of these two STANDARDS.

4.10.4.5.3 Unisex

Increasingly, many AQUATIC VENUES are providing family dressing areas and caregiver rooms to attend to family needs. This provision permits parents to attend to the needs of small children of the opposite sex.

4.10.4.5.4 Trash Can

Trash receptacles are needed to help maintain cleanliness around the DIAPER-CHANGING STATION for any disposable changing unit covers, diapers, SANITIZING wipes, or disposable paper towels.

4.10.4.6 Non-Plumbing Fixture Requirements

4.10.4.6.4 Lockers

While some lockers are designed to sit directly on the floor, other lockers may need to be elevated. This prohibits water accumulation beneath the lockers. Such accumulation can lead to the growth of mold, mildew, and slime build up. The MAHC has gone with the current industry STANDARD of 3.5 inches (8.9 cm) high but recommends moving to a new STANDARD of 6 inches (15.2 cm) to allow better access, cleaning, and drying under the lockers.

4.10.4.6.6 Dryers / Paper Towels

Hand drying devices or paper towel dispensers should be located adjacent to the hand washing sinks to facilitate use. To prevent overcrowding, they may be positioned to move users away from the sink and toward the exit. In childcare settings, the dispensers and devices are usually within arm's reach of the sink.

4.10.5 Provision of Suits, Towels, and Shared Equipment

Although providing reusable bathing suits is no longer common, many AQUATIC FACILITIES provide PATRONS with towels and other shared equipment. The purpose of this wording STANDARD is to ensure that these AQUATIC FACILITIES provide adequate equipment and space in their design and construction for laundering, SANITIZING, and drying these items.

4.10.6 Foot Baths

FOOT BATHS with standing water allow the buildup of organic material and bacterial and fungal growth and can lead to the spread of pathogens.

4.10.7 Sharps

This section was included to address AQUATIC VENUES that provide PATRONS with sharps, especially razors, so that safe disposal is assured. Approved sharps containers are rigid, leak-proof, puncture resistant boxes of various sizes made of hard red plastic. They have a lid that can be securely sealed to keep contents from falling out, and they are clearly marked with the bio-hazard symbol. OSHA regulations describe the design and use of sharps containers for a variety of settings.

Businesses are required by OSHA to deposit sharps into a sharps container that complies with OSHA regulations in order to protect employees. Once that container is full, it must be disposed of according to state and federal regulations.

4.12 Specific Aquatic Venues

4.12.10 Floatation Tanks

“Floating” is a health and wellness practice in which users float in a saturated Epsom salt solution (MgSO_4). The practice is intended to reduce sensory input through several means. The dense, highly buoyant solution allows users to float without effort, and is maintained at or near the external temperature of the skin (93.2-95°F/34–35°C). The “float tanks” in which floating occurs may vary greatly in design (ranging from open basins to chambers to pods), but are generally designed to reduce light and sound penetration. However, some tank designs may provide sensory inputs in the form of colored lights, sounds, or aromatherapy. Although FLOATATION TANKS are typically found in commercial float centers containing multiple units, they could be installed in a range of settings. The academic literature on FLOATATION TANKS is limited. There is a growing body of research examining potential health benefits. Recently, the National Collaborating Centre for Environmental Health (NCCEH) produced two documents related to potential environmental health risks of floating and an overview of guidance and lack of regulation pertaining to these devices. A second literature review of microbial risks was also produced by Public Health Ontario.

4.12.10.1 Design and Construction

Due to the unique nature of the FLOATATION TANK SOLUTION and the nature of use of FLOATATION TANKS, the typical system design criteria detailed in MAHC Section 4 are not appropriate. The MAHC provisions that are applicable are individually listed. NSF International developed criteria to test and certify FLOATATION TANK systems, components and related equipment; those criteria can be found in NSF CCS-12804. While developing and refining the proposed requirements for the MAHC, the CMAHC Floatation Tank Ad Hoc Committee identified areas of the CCS-12804 that are inconsistent with the MAHC proposals, which can cause confusion, and other areas to be considered for revision. Due to these inconsistencies and potential for further changes to CCS-12804, the Committee chose to specify only certain CCS-12804 provisions instead of requiring compliance and certification to the complete STANDARD at this time. Upon additional discussion and review of submitted

comments, it was decided to remove the reference to CCS-12804 at this time while incorporating some of the specific provisions into the proposed requirements for the MAHC.

5.0 Aquatic Facility Operation and Maintenance

5.10 Hygiene Facilities

5.10.4 Plumbing Fixture Requirements

5.10.4.1 General Requirements

Toilets and SHOWERS should appear clean and ready to use to attract BATHERS to use them. Although the MAHC is not aware of any work in this particular setting, studies in child care settings, schools, long term care facilities and food service establishments all support the importance of surface cleaning. The MAHC feels that daily cleaning at a minimum in this setting is reasonable for aesthetics as well as health and SAFETY. It is important to both clean and SANITIZE (or DISINFECT) HYGIENE FACILITY surfaces. EPA regulates all products, including surface cleaning products, that kill germs (<https://www.epa.gov/pesticides>). Therefore, when SANITIZING or DISINFECTING HYGIENE FACILITY surfaces, an EPA REGISTERED product must be used. The general term used by EPA is “pesticides” which are defined as any substance or mixture of substances intended for preventing, destroying, repelling or mitigating any pest. Pests include harmful microorganisms such as bacteria, viruses, and mold. During the registration process for pesticides, EPA considers both the ecological and human health risks of products as well as their efficacy. Consideration can also be given to the overall environmental impacts that these cleaning products have. UL 2759 is a publicly available STANDARD that establishes human health and environmental criteria for hard surface cleaners. This STANDARD is designed to reduce environmental impacts by specifying criteria for safer chemicals and materials, use of recycled and recyclable materials, and minimizing pollution generated by the production, use, and disposal of these products and their packaging.

5.10.4.3 Rinse Showers

Soap is not needed at RINSE SHOWERS because it can have a negative effect on water chemistry.

5.10.4.5 Diaper-Changing Stations

It is the responsibility of PATRONS to clean diaper changing surfaces after each use. This is consistent with practice in other public settings where diapering takes place. However, staff should keep an eye on stations and clean when necessary.

5.10.4.6 Non-Plumbing Fixture Requirements

Associations between AQUATIC VENUES and disease outbreaks have been well documented in the literature. Though an outbreak has never been connected to the materials used specifically, wood and other porous materials have been shown to have bacterial growth on them that can be hard to remove. Non-porous materials used as matting at AQUATIC FACILITIES were found to be contaminated with bacteria and biofilm scum layers, although conventional cleaning was documented to remove the contamination. Biofilms are a complex collection of microbes that attach to a wet surface and form a scum layer that harbors bacteria and other microbes that could cause illness. Once established, biofilms provide a home for a variety of microbes such as *Pseudomonas* and are hard to remove. Biofilm-associated bacteria are much more resistant to HOCl compared with free swimming microbes. Design options to reduce biofilm formation as well as SANITIZING systems with effective validation, could be useful for reducing biofilm formation.

5.10.5 Provision of Suits, Towels, and Shared Equipment

5.10.5.1 Towels

The drying temperature is more important than the wash temperature when destroying potential infectious pathogens.

- See CDC recommendations for laundering entitled, “Environmental Cleaning & Disinfecting for MRSA” at: <http://www.cdc.gov/mrsa/community/environment/>.

5.10.5.4 Shared Equipment Cleaned and Sanitized

Research has demonstrated that play features, mat materials, and other shared equipment found at AQUATIC FACILITIES and water parks can harbor bacteria, even while submerged in chlorinated water. Damp materials that

were not submerged in water contained the highest populations of bacteria. Damp play features designed for infants and toddlers were found to be likely vehicles for transference of gastrointestinal bacteria. **SANITIZATION** is defined as reducing the level of microbes that are considered safe by public health **STANDARDS**. This may be achieved through a variety of chemical or physical means including chemical treatment, cleaning, or drying. Associations between swimming **POOLS** and disease outbreaks have been well-documented in the literature. Though an outbreak has never been connected to play features or the type of play feature material specifically, the possibility could exist due to biofilms found on these materials. Outbreaks may be more likely if the **AQUATIC FACILITY** is not maintained properly. Biofilms are structured communities of microorganisms encapsulated within a self-developed polymeric matrix that adhere to a living or inert surface. In **AQUATIC VENUES**, biofilms form readily in water distribution and recirculation lines, filters, collector tanks, and swimming **POOLS**. Biofilms form when bacteria begin to excrete a slimy, sticky substance that allows them to adhere to surfaces. The biofilm mass usually consists of many species of bacteria, and can also include fungi, algae, and protozoa. Biofilms are resistant to **CHLORINE** and are difficult to remove once initial adhesion occurs. The biofilm slime shelters disease-causing microorganisms, protecting them from **CHLORINE DISINFECTION**. In addition, biofilms exert an oxidant demand, consuming **CHLORINE** residuals in the distribution line and requiring higher doses at the treatment station for residual maintenance at the end of the line. Design options to reduce biofilm formation as well as **SANITIZING** systems with effective validation, could be useful for reducing biofilm formation.

Contact

Shared equipment that contact mucous, saliva, eyes, or ears require **SANITIZING** to prevent transmission of potential disease causing pathogens.

5.10.5.5 Other Equipment

Shared equipment which is hand held or used as a flotation device used in aquatic therapy or play have also been found to harbor potential harmful microorganisms, even while submerged in properly chlorinated water. Bacteria found in these environments are most likely from biofilms that have attached to these surfaces. Soaking in **DISINFECTANTS** may not be enough to penetrate the biofilm; so to control biofilm growth, it is recommended to physically remove the slimy film by scrubbing equipment on a routine basis. The array of organisms isolated from damp features suggests that features need to be cleaned, **SANITIZED**, and thoroughly dried on a routine basis using a combination of chemical and physical methods, preferably as recommended by the manufacturer.

5.12 Special Requirements for Specific Venues

5.12.10 Floatation Tanks

See MAHC 4.12.10 for general discussion

6.0 Policies and Management

6.4 Facility Management

Facility management is critical in preventing illness and injury as summarized in this section. The CDC identifies the most frequently reported contributing factors to the spread of infectious pathogens that cause RWIs, in particular gastroenteritis. Another report identified the most frequently reported type of RWI outbreak as gastroenteritis, the incidence of which is increasing. Prevention of RWIs at treated venues requires POOL operators to:

- Maintain appropriate DISINFECTANT concentration and pH to maximize DISINFECTANT effectiveness, and
- Ensure optimal water circulation and filtration.

A study of POOL inspection data underscored the need for improved maintenance. A total of 4,873 (11.6%) of 42,161 inspections identified serious violations that threatened the public's health and resulted in immediate POOL closure. Of 40,585 inspections, 3,549 (8.7%) identified DISINFECTANT concentration violations; of 38,247 inspections, 4,506 (11.8%) identified pH violations. Automated chemical feeder violations were documented during 2,260 (6.3%) of 36,137 inspections. Only one (6%) of 16 included data on AQUATIC FACILITY setting; almost all POOL (99.5% [55,622/55,913]) and hot tub/SPA (99.1% [20,259/20,449]) inspection records were missing data on AQUATIC FACILITY setting. Use of the setting algorithm increased the number of inspection records with setting data; however, after the setting algorithm was run, 75.6% (42,249/55,913) of POOL and 84.2% (17,213/20,449) of hot tub/SPA inspection records still were missing AQUATIC FACILITY setting data, thus no analyses stratified by setting were conducted. The process of submitting, reformatting, STANDARDIZING, and analyzing these data highlighted several areas where the collection and STORAGE of AQUATIC FACILITY inspection data could be improved. To optimize collection and analysis of AQUATIC FACILITY inspection data and thus utility in informing program planning, implementation and evaluation, a collaboration of federal, state, and local partners from different disciplines is needed. This collaboration should include environmental health practitioners with technical knowledge about the operation and maintenance of public AQUATIC FACILITIES and with inspection experience, epidemiologists skilled in conducting surveillance and data analysis, and information technology specialists with expertise in database construction. This collaboration could provide input on identifying public AQUATIC FACILITY CODE elements deemed critical to protecting public health and on the creation of needed resources (e.g., STANDARD inspection forms, training for inspectors, criteria for the construction of databases, and of tools to analyze data). Kiddie/WADING POOL inspections had the highest percentage of immediate closures (21.6%). Inspections of kiddie/WADING POOLS identified the highest percentage of DISINFECTANT concentration violations (19.2%), followed by inspections of INTERACTIVE WATER PLAY VENUES (10.1%). See MAHC Sections 1.2.1 (RWI Outbreaks), 1.2.2 (Significance of *Cryptosporidium*), 1.2.3 (Drowning and Injuries), and 1.2.4 (Pool Chemical-Related Injuries) for further discussion and background. The information identified in these reports, along with existing recreational water injury data and first hand inspector experience, drove the development of the critical risk factors for recreational water injury and illness at treated AQUATIC VENUES. The eight broad critical risk factors for recreational water illness and injury are:

- Management; supervision; training; operation;
- Lifeguard services;
- DISINFECTANT residual;
- pH (*low or hi*);
- Water clarity;
- Facility ENCLOSURE / entry protection;
- Entrapment protection; and
- Water supply / waste disposal.

Low concentration or absent DISINFECTANT leads to reduced inactivation of pathogens and these conditions have been associated with infectious disease outbreaks. Low pH has been associated with loss of dental enamel. Dental erosion begins to occur below pH 6.0 and rapidly accelerates as the pH drops. High pH reduces the efficacy of CHLORINE-based DISINFECTION by reducing the amount of molecular HOCl, the active form that is available for DISINFECTION. At pH 7.0, about 70% of the HOCl is molecular, at pH 7.5 about 50% is molecular, at pH 8.0

about 20% is molecular, and at pH 8.5 only 10% is molecular. As a result, the MAHC decided to set upper and lower limits for pH (recommended pH range 7.2–7.8) as an IMMEDIATE HEALTH HAZARD.

6.4.2 Patron-Related Management Aspects

6.4.2.2 Signage

The purpose of these requirements is to limit injuries and the spread of communicable disease. The wording used is not prescriptive since it is the intent that must be covered; this allows managerial creativity to be used as long as the intent of the wording is conveyed. Healthy swimming messages can also be put on posters to be hung in bathroom stalls, at the AQUATIC FACILITY entrance, on the back of ticket stubs, and in group-event contracts. Ideally, signage should be provided to encourage BATHERS to take a second SHOWER after using the toilet before reentering the AQUATIC VENUE. While this requirement may be difficult to enforce, the posting of such signs may encourage compliance or, at a minimum, raise awareness about the importance of BATHER hygiene. Consider the needs of clients and provide effective communication which could include signs in more than one language, Braille, etc.

6.4.2.2.3 Sign Messages

Need for adult supervision: The American Academy of Pediatrics, Policy Statement- Prevention of Drowning states: Whenever infants and toddlers (or weak swimmers) are in or around water, be it in a POOL or an open BODY OF WATER, a supervising adult with swimming skills should be in the water, within an arm's length, providing "touch supervision." With older children and better swimmers, the eyes and attention of the supervising adult should be constantly focused on the child, and the adult should not be engaged in other distracting activities that can compromise this attention, such as talking on the telephone, socializing, tending chores, or drinking alcohol. The MAHC needs to further discuss the term and implications of requiring "touch supervision". Although it may be appropriate for some children at some AQUATIC FACILITIES, it may not be appropriate at other AQUATIC FACILITIES. Regardless of whether the term is used, it is good practice for each AQUATIC FACILITY to set a minimum age under which parental/caregiver supervision is required. Suggested content for WATERSLIDES should also include content on their signs to comply with the manufactures recommendations. Minimum content should include:

- Rider position,
- Number of riders allowed at a time,
- Dispatch instructions,
- Water depth at SLIDE exit,
- Weight limit as established by manufacturer, and
- Height requirement if specified by manufacturer.

For sign message #13) ("No animals in the AQUATIC VENUE and no animals on the DECK, except service animals, if applicable"), this exception applies to the DECK, not for the POOL water. Service animals are regulated under the Americans with Disabilities Act (ADA). An ADAAG interpretation found on ADA's "Frequently Asked Questions about Service Animals and the ADA," found at www.ada.gov/regs2010/service_animal_qa.html. See question 33 below:

- Question: Are gyms, fitness centers, hotels, or municipalities that have swimming POOLS required to allow a service animal in the POOL with its handler?
- Answer. No. The ADAAG does not override public health rules that prohibit dogs in swimming POOLS. However, service animals must be allowed on the POOL DECK and in other areas where the public is allowed to go.

6.4.2.3 Swimmer Empowerment Methods

6.4.2.3.1 Public Information and Health Messaging

The MAHC felt strongly that public education and health communication with users should be required at any INDOOR AQUATIC FACILITY. This messaging should make clear the responsibility of the user to SHOWER before entering the POOL and that they should not urinate in the POOL. It is known that urine and sweat contribute nitrogen to the POOL resulting in chloramines. By actively limiting the introduction of urine and sweat, the result should be

fewer chloramines in the POOL and the air. A summary of health and exposure data can be found in MAHC Appendix 1: Summary of Health and Exposure Data for Chemical and Biological Contaminants.

6.4.2.3.2 Post Inspection Results

There are only a relatively small number of municipal organizations that require public or web-based disclosure of inspection reports. However, as inspection activity is tax-payer supported, there is a growing trend toward requiring public disclosure. One recent example is the Beaches Environmental Assessment and Coastal Health (*BEACH*) Act of 2000, a Federal Act that requires public disclosure of coastal beach closings. Additionally, DeKalb County, Georgia requires the public posting of inspection results for aquatic facilities as well as posting them on the internet, which is similar to the ever expanding requirement for posting inspection results at food service establishments. The posting of inspections at aquatic facilities will increase public awareness of aquatic safety and health and encourage aquatic operators to comply with all code requirements. Most jurisdictions require the permit to be conspicuously posted. This is to inform the public that the facility has met the minimum safety standards required by law.