The Model Aquatic Health Code (MAHC) and Council for the MAHC (CMAHC): Update and Review of the 2017 CMAHC Biennial Conference

International Pool and Spa Expo Conference
Orlando, FL
November 1, 2017
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Outline

- Public health rationale for the MAHC
- What is the MAHC?
- Case Studies
- MAHC Adoption
- Keeping the MAHC up to date
- Update on Change Requests from the 2017 CMAHC Biennial Conference
PUBLIC HEALTH RATIONALE FOR THE MAHC
Why Develop Model Pool Code Guidance? Supporting the Health Benefits of Swimming!

- One of top sports and exercise activities in the US
  - > 1 billion days/visits a year by over 1/3 of U.S. population
- Low impact exercise improves joint use with arthritis and cardiovascular health
- Improves mood
- Improves quality of life and reduces disability
- Maintains bone health for post-menopausal women

For more information, see http://www.cdc.gov/healthywater/swimming/health_benefits_water_exercise.html:
Public Health Issues Detracting from Aquatics Benefits

- Drowning ~3500/people/yr\(^1\)
- Spinal cord injuries from diving (~450/yr)\(^2\)
- Indoor air quality issues\(^3\)
- Pool chemical-associated injuries caused ~5000 people ED visits in 2012\(^4\)
- Waterborne outbreaks significantly increase\(^5\)
- High rate of pool (12.1%) and spa (11%) closures during routine inspections\(^6,7\)

Current Pool Code and Regulation Situation

- **Current code development at the state or local level**
  - Little federal regulation, no federal jurisdiction
- **May or may not include regulated party/industry input**
- **Requires significant staff resources and time to research, prepare, and develop code language**
- **Local HD (68% have pool codes) responsible for defending proposed changes from needs/benefits and cost impact standpoint**
WHAT IS THE MAHC?
What is the Vision for Aquatics? Why Are We Here?

- Public pools/waterparks/spas in every community
  - Well operated and they remain open on inspection
- Everyone knows how to swim
- All age groups enjoy health, social, and family benefits
- Healthy and safe experiences for everyone
  - Improving swimmer ability, knowledge, and hygiene
  - Reducing drowning
  - Reducing chemical and other injuries
  - Limiting disease outbreaks
- The MAHC can achieve the long range vision using incremental change to move aquatics towards the vision
  - Examples: Improved shell designs, filtration systems, water and air quality, bather supervision
How Do We Get There?

What is the MAHC?

- Voluntary model public pool and spa code based on science and best practices created by CDC in a nationwide public health and industry partnership
- States and localities can use the MAHC to create or update existing pool codes
  - To reduce risk for outbreaks, drowning, and pool-chemical injuries
  - Save resources; no need to reinvent codes in every jurisdiction
- All-inclusive; addresses design and construction; operation and maintenance; policies and management of public aquatic facilities
  - No other model code covers everything needed by public health
MAHC Scope

- All areas of public health concern
  - Public venues, NOT residential
  - Illness, injury, drowning
  - Water, air, & facility exposures that impact the health of swimmers and facility users
  - Leave other areas to building codes, etc.

- Facility types
  - Man-made, treated, recirculated water venues
  - Health care-based pools
  - Therapy pools
MAHC Building Blocks

- Data or best practices driven
  - Avoid prescription when possible
- Free and accessible for all
  - Posted on CDC’s Healthy Swimming website
- Implementable
  - Incremental change: “Evolution, not revolution"
- Updated regularly
  - Current update cycle is every 3 years
- Partnership-based
  - Built by public health and aquatics sector partnership
- Easy to understand with cited rationale for requirements
  - Code section accompanied by “Annex” that includes data and rationale for code requirements
MAHC Partnership Rationale

- Incremental change is most likely to be adopted by state and local jurisdictions
- Partnership will yield the best product, greatest buy-in, and will be most likely to be adopted
- Incorporating public input improves overall quality and national buy-in
- Developed as modules from 2007-2014 culminating in release of MAHC 1st Edition in August 2014
  - >150 people from across PH, aquatics, academia
  - Two rounds of public comment with over 4400 comments and >70% acceptance rate
## MAHC in Context

<table>
<thead>
<tr>
<th>Document type?</th>
<th>Model code, not a law</th>
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<tbody>
<tr>
<td>Creation Process?</td>
<td>CDC led, with substantial input from state and local public health, aquatics sector, and academia Evolution NOT revolution</td>
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<tr>
<td>Public comment?</td>
<td>Yes, two public comment periods plus 3rd comment period when users choose to adopt</td>
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<td>Can be updated?</td>
<td>Yes, improvements based on data and expertise from public health and aquatics</td>
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<td>Enforceable?</td>
<td>Must be adopted by state or local authority first</td>
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<tr>
<td>All pools?</td>
<td>No, only public facilities in adopting jurisdictions. Also, design and construction provisions mostly apply to new and remodeled construction</td>
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What’s Inside the MAHC?

1) Preface
2) User Guide
3) Glossary, Acronyms, Initialisms
4) Design and Construction
5) Operation and Maintenance
6) Policies and Management
7) MAHC Resources
8) Appendices
Key Changes: New Construction or Substantial Alteration

- Most of Design and Construction chapter is for new construction or substantial renovation
- Secondary disinfection on increased risk venues (kiddie)
- Rinse showers required at aquatic venues
- Decreased filtration flow rate used in design
- Increased backwash rates
- Fencing height and mesh size altered
- Hygiene facility distance from pools specified
- Types of pools requiring lifeguards
  - Any new pool over 5 feet in depth will require a LG
Key Changes:
Within 1 year of Adoption or Less

- Automated controllers and feeders
- Interlocks between feeders and recirculation
- Improved flow meters
- Diaper-changing stations (sink or similar use item)
- Operator training requirements
- LG zones of patron surveillance now performance-based with identified performance criteria
- Required preventive maintenance checks and plan
- Policies: EAP, employee illness, body fluid response, pool surface cleaning to reduce biofilm
CASE STUDIES
CASE STUDY #1: REDUCING THE RISK OF CHLORINE OUTGASSING EVENTS
Reducing the Risk of Chlorine Outgassing Events

- June 2015: Contra Costa County hazmat team called about chlorine gas release at local waterpark in pool with ~50 swimmers
  - Thirty-four children experienced coughing, vomiting, and eye irritation after being exposed to toxic chlorine gas.
  - Twenty-two children were evaluated at emergency department
  - One child hospitalized overnight for treatment and observation
- Eight additional episodes identified over previous 8 years
Reducing the Risk of Chlorine Outgassing Events: How Does the MAHC Help?

- Chemical feeder interlocks between two of following
  - Recirculation pump, flow switch in line, controller and flow cell
- Chemical storage requirements
- Air handling standards
- Reporting of events to health department
CASE STUDY #2: REDUCING THE RISK AND SPREAD OF CRYPTOSPORIDIUM
Reducing the Risk of *Cryptosporidium* Outbreaks

- **Phoenix AZ, 2016**
  - 7-fold increase in crypto cases reported
  - Little League team infected during attendance at local waterpark
  - >80 aquatic facilities involved

- **Columbus OH, 2016**
  - 5-fold increase in Crypto cases, community-wide
  - Large waterpark involved as well as other aquatic facilities
  - University swim team involved
Aquatic Facility–associated Outbreaks, by Year — United States, 1978–2012 (n=650)*

- 2003–2012
  - 343 outbreaks
  - > 22,000 cases

Source: Hlavsa MC et al, 2015. MMWR 64(24): 668-672
Outbreaks of Acute Gastrointestinal Illness associated with Treated Recreational Water (n=198) United States, 2003–2012

Cryptosporidium spp. (“Crypto”) 79.8%

Unidentified 5.1%

Other* 2.0%

Cryptosporidium spp. 79.8%

Shigella spp. 3.0%

E. coli 2.5%

Norovirus 4.0%

Giardia 3.5%

*Other includes Campylobacter (n=1) and multiple etiologies (n=3).

Extremely chlorine tolerant

Chlorine sensitive:
Poor pool operation & maintenance

Reducing the Risk of *Cryptosporidium* Outbreaks: 
How Does the MAHC Help?

- **New construction**
  - “Increased risk” venues (kiddie pools, splash pads) required to have secondary disinfection (UV, ozone)---Crypto highly chlorine tolerant but susceptible to UV and ozone
  - Hygiene facilities within 200 (under 5 yo area) or 300 (adult) feet

- **Upon adoption**
  - Diaper changing stations to improve hygiene, limit exposure

- **Operation and Policy**
  - Fecal incident response for diarrheal incidents (presumed crypto) requires closure and hyperchlorination
  - Messaging to bathers

- **Outcomes: Both waterparks installed UV systems**
CASE STUDY #3: PROTECTING SWIMMERS FROM DROWNING
Protecting Swimmers from Drowning

- 2017: Certified lifeguard in CT charged with reckless endangerment after saving 5yo child from drowning at indoor public pool
  - Guard rescued child and started CPR
  - First responders continued CPR
  - Child resuscitated, recovered rapidly in hospital, and returned home for further recovery
  - Child was underwater for 4 minutes based on video surveillance
  - Video showed guard was not talking or distracted by electronic device, etc.

- Shallow pool at multi-venue facility, only guard at that venue
Protecting Swimmers from Drowning 2017: How Does the MAHC Help?

- Lifeguard zones of surveillance part of original plan design so all zones have unrestricted vision
  - LG zones of surveillance performance-based with identified performance criteria
- During re-design, major renovation design professional must alert owner that addition of features, etc. that obstruct zone may require additional staffing
- Lifeguard zones of surveillance must be assessed to ensure glare does not obstruct vision
- Breaks every hour to increase vigilance
MAHC ADOPTION
MAHC Adoption Status

- **Key considerations**
  - States must review and fit into regulatory process and timeframe: adoption can take ≥ 2 years; Food Code sped up after 3-6 years

- **Endorsements**
  - NACCHO 2015; NEHA 2017; CSTE 2017; WWA Kelly Ogle Safety Award 2017

- **Adoption**
  - Full adoption: NM (08/01/2016 after 2+ years prep); Nova Scotia, Canada
  - Partial adoption: GA, FL, DE, PWTAG/UK
  - In review for potential full/partial adoption: almost 30 jurisdictions such as AZ; CO; IA; IN; MD; NY; OH; Southern Nevada/Las Vegas, Ontario, Canada; Colombia

- **Clear role for aquatics sector advocacy to speed adoption**
Visible Groundswell Following MAHC Release: Becoming a Standard While Waiting for Adoption

- Operational adoption: Use in operations, MAHC-compliant operational materials, and operational assistance
  - e.g., YMCA operations manual, Great Wolf Lodge operational guidance, Jeff Ellis & Assoc. guarding materials
- Variances granted: MAHC-based variances/waivers given liberally to requestors while discussing adoption (e.g., FL, NY, CT)
- Surrogate pool code: States without a pool code pointing to MAHC for design, operation, management guidance (e.g., MS)
- Acceptance of design requirements: MAHC design features becoming accepted and not immediately removed from designs due to cost
  - Clients signing liability waivers if they require removal (e.g., secondary disinfection on increased risk venues)
- Being referred to as standard of care
How Will the MAHC Be Kept Up-To-Date?

- CDC owns, revises, and publicly posts the MAHC
- Need to renew and update
  - Self-sustaining mechanism
- Needs a conduit to gather input on improvements
  - Public health, aquatics, academia, general public
- Conduit needs to
  - Gather national input, decide on scientific merit, and summarize changes needed for CDC to accept into next MAHC edition
MAHC RENEWAL: KEEPING THE MAHC UP-TO-DATE
The Conference for the Model Aquatic Health Code (CMAHC)

- What is CMAHC?
  - 501c(3) non-profit organization

- Why does it exist?
  - Organized in 2014 to manage updates to the MAHC

- Administration & Operation
  - Bylaws, Board of Directors, Executive Director
  - Membership over 700 and costs $30/year
  - Committees include Technical Review Committee and Ad Hoc Committees

- Modeled after Conference for Food Protection that oversees FDA Model Food Code
The Conference for the Model Aquatic Health Code (CMAHC)

- **Role**
  - National clearinghouse for data-driven, science-based information from public health and aquatic industry experts to improve and support use of the MAHC

- **Vision**
  - An up-to-date, science-based, sustainable, easily understood MAHC that is implemented by pool programs across the U.S. to support healthy and safe aquatic experiences for everyone
The Conference for the Model Aquatic Health Code (CMAHC)

- **Mission**
  - Collect, assess, and relay input on MAHC revisions back to CDC for final acceptance
  - Provide advocacy and needed support to health departments and other partners on using the MAHC
  - Solicit, coordinate, and prioritize research needs

- **Works through**
  - Conference discussing Change Requests every 3 years
  - Technical reviews of potential changes
  - Ad Hoc and Standing Committees to drive work
CMAHC Operational Outline for Proposing Changes to the MAHC

1. Input
2. Change Request
3. Technical Review & Discussion
4. CMAHC Biennial Conference Presentations
   - 7 Technical Support Committees
   - Voting
   - Board of Directors
   - CDC

Ad Hoc Committees
2017 CMAHC CONFERENCE CHANGE REQUESTS AND DISCUSSION
Reducing the Risk of Chlorine Outgassing Events: How Does the MAHC Help?

- Based on reported incidents, additional safeguards proposed via CRs:
  - Visual alarm or other indication if feeder turns off
  - Bathers removed if pumps shut off
  - No bathers for 5 minutes after pumps turned on or while backwashing
  - Monthly testing of feeder interlocks
  - Reporting of events to health department
Reducing the Risk of Chlorine Outgassing Events: How Does the MAHC Help?

- Based on reported incidents, additional safeguards proposed (cont.):
  - Chemical handling training
  - EAP plan must include accidental chemical release plan
Wing Wall Use

- Summary:
  Limit use of wing walls immediately adjacent to deep water or beginner's areas.

- Rationale for CR
  Design changes can maintain the intended uses while eliminating the hazard associated with the abrupt depth change across the wing walls.
Technical Review Committee Report

Wing Wall Use

- Summary of pros and cons and/or benefits or deficits

**Pros:** Not having a shallow area directly adjacent to a deep area can potentially eliminate some hazards.

**Cons:** The CR as written, if not banning wing walls entirely, is highly restrictive. A wing wall could not be located at any location where the water is 3’ deep or less or 5’ deep or more, on one side. This would mean that a wing wall can only be located at a water depth of 4 feet and the water depth cannot really change on either side.

Wing walls are sometimes used as LG stations allowing them better visibility and/or access to certain areas of the pool.
New Acoustical Design Guidelines

- Many indoor meets exceed OSHA standards on noise. Addresses the finishes, construction assemblies, and MEP (mechanical; engineering; plumbing) system noise in indoor aquatic facilities

- Suggested changes
  - 4.6.11.2A Sound Absorption
    Indoor aquatic facilities shall be designed, constructed and installed with an average sound absorption coefficient (Alpha Bar) of 0.20 or greater.
      - 4.6.11.2.1A Facilities Used Primarily by Specific Hearing Populations
        An Alpha Bar of 0.25 or greater shall be used for indoor aquatic facilities designed primarily for use by children, the elderly, or persons with hearing difficulties.
Technical Review Committee Report
Acoustics

- Summary of pros and cons and/or benefits or deficits

**Benefits:** The health effects of noise, impact of noise on task performance and lifeguard vigilance, and the condition of noise-induced hearing loss are well documented.

**Deficits:** Difficult to quantify potential design and construction cost increase. Sound absorption materials are readily available and used in other facilities. Many design firms and AHJ plan review staff are unfamiliar with acoustical design considerations: education will be critical to incorporation of these criteria. Recent implementation of acoustic design criteria for public schools/hospitals shows it is achievable.
Certification, Listing, Labeling of Pool Chemicals

- **Summary:** Include certification to NSF/ANSI Standard 50 as a specification/requirement for pool chemicals.

- **Suggested changes:**
  Chemicals used in recreational water facilities shall be certified to NSF/ANSI 50 by an ANSI accredited certification organization.

  - **pH, oxygen feedstock, stabilizers, salt, clarifiers/flocs**

- **Rationale:** The chemical safety evaluations under NSF/ANSI 50 provide verification that recreational water treatment products do not impart undesirable levels of chemical constituents or contaminants to the water. The evaluations include the oral, dermal, and inhalation exposure of chemicals.
Summary of pros and cons and/or benefits or deficits

Pros: Chemical safety evaluations verify the recreational water treatment products do not impart undesirable levels of either chemical constituents or contaminants to the water. Provides operators and regulators a means to determine if chemicals are appropriate for use in aquatic venues.

Cons: Certification, listing and labeling of chemicals to NSF-50 Annex R will increase the cost of pool chemicals. Requiring certifications of chemicals may limit competition and product choices.
**Chlorinator Sizing**

1. **AQUATIC VENUES** shall be required to maintain the minimum Free Available Chlorine (FAC) per section 5.7.3.1.1.2 at all times but have no specific dosing rate requirement based on volume alone.

2. Sizing of chlorine dosing equipment shall be based on chlorine demand factors: surface area, volume, type of use/-space (flat water, agitated water, hot water), venue type (pool, spa, wading pool, etc.), indoor/outdoor sunlight/UV exposure, max water temp, bathers, CYA usage, water loss, vegetation and airborne debris.

3. Registered/Licensed Design Professional will document adequate dosing size and capacity for the AQUATIC VENUE.

4. If upon operation the feed system is incapable of maintaining minimum FAC at all times additional capacity shall be provided.
Chlorinator Sizing

- A key precept of the MAHC is that it be performance based
- Maintaining a minimum FAC as required by this CR is safe and performance based
- This CR does not restrict the ability of the facility to install a unit optimized to the chlorine demand/use pattern of that facility, potentially reducing capital equipment investment
- Economic differences between alternative sanitation methodologies are eliminated by removing code that requires unnecessarily excessive prescriptive dosing
Other Change Requests

- Splashpad feature water 100% treated by secondary disinfection (YES)
- Drop stabilizer levels from 90 ppm to 25 ppm (NO)
- Reduce pH minimum to 6.8 (NO)
- Slides must take into account patron weights in loading rides (YES)
- Lifeguard required if
  - Alcohol served at venue (YES)
  - Greater than 4 ft (NO)
  - Width greater than 30 ft (NO)
  - No certified operator on site (NO)
  - Kids under 14 not actively excluded (NO)
  - No person certified for CPR/AED use on-site (NO)
CONCLUSIONS & FUTURE DIRECTIONS
Anticipated Public Health Outcomes

- Saves state/local resources creating/updating codes
- Fewer pool/facility closures
- Improved collection and use of inspection data
- Development of a research agenda to fill gaps
- Data-based uniformity in key areas
- Fewer outbreaks of recreational water illnesses resulting from exposure to contaminated swimming water
- Fewer drowning and pool chemical incidents
MAHC
More Information: Search on “CDC MAHC” or visit the Healthy Swimming MAHC Website: www.cdc.gov/mahc
Email: mahc@cdc.gov

CMAHC
More Information: Search on “CMAHC” or visit the CMAHC Website: www.cmahc.org
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QUESTIONS ?