

Model Aquatic Health Code

Facility Maintenance and Operation Annex Section Modified after the First 60-day Review that Closed on 12/29/2011

Informational Copy: NOT Currently Open for Public Comment

This version of the MAHC Facility Maintenance and Operation Module has been modified based on the first round of public comments received. It is being re-posted so users can view how it was modified but is not currently open to public comment. The complete draft MAHC, with all of the individual module review comments addressed will be posted again for a final review and comment before MAHC publication. This will enable reviewers to review modules in the context of other modules and sections that may not have been possible during the initial individual module review. The public comments and MAHC responses can be viewed on the web at <http://www.cdc.gov/healthywater/swimming/pools/mahc/structure-content/index.html>

The MAHC committees appreciate your patience with the review process and commitment to this endeavor as we all seek to produce the best aquatic health code possible.

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MAHC Facility Maintenance and Operation Module Abstract

Aquatic facility operation and maintenance is a critical component of maintaining health and safety. Past outbreaks have commonly found operation and maintenance lapses to be critical contributors to disease outbreaks and injuries. The Facility Maintenance and Operation Module lays the foundation for operational improvement by containing requirements for:

- 1) Closure and reopening guidance for long and short term closures.
- 2) Comprehensive plans for preventive maintenance, equipment inventorying, and development of an operations manual to be maintained at the facility.
- 3) Reducing and mitigating excessive glare and reflection on the pool surface through design and adjustments to windows and lighting equipment.
- 4) Comprehensive daily records of pool operation & maintenance and of operational items inspected daily.

The Facility Maintenance and Operation Code Module shows a Table of Contents giving the context of the Facility Maintenance and Operation in the overall Model Aquatic Health Code's Strawman Outline (<http://www.cdc.gov/healthywater/pdf/swimming/pools/mahc/structure-content/mahc-strawman.pdf>).

Note on the MAHC Annex

Rationale

The annex is provided to:

- a) Give explanations, data, and references to support why specific recommendations are made;
- b) Discuss the rationale for making the code content decisions;
- c) Provide a discussion of the scientific basis for selecting certain criteria, as well as discuss why other scientific data may not have been selected, e.g. due to data inconsistencies;
- d) State areas where additional research may be needed;
- e) Discuss and explain terminology used; and
- f) Provide additional material that may not have been appropriately placed in the main body of the model code language. This could include summaries of scientific studies, charts, graphs, or other illustrative materials.

Content

The annexes accompanying the code sections are intended to provide support and assistance to those charged with applying and using Model Aquatic Health Code

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provisions. No reference is made in the text of a code provision to the annexes which support its requirements. This is necessary in order to keep future laws or other requirements based on the Model Aquatic Health Code straightforward. However, the annexes are provided specifically to assist users in understanding and applying the provisions uniformly and effectively. They are not intended to be exhaustive reviews of the scientific or other literature but should contain enough information and references to guide the reader to more extensive information and review.

It is, therefore, important for reviewers and users to preview the subject and essence of each of the annexes before using the document. Some of the annexes (e.g., References, Public Health Rationale) are structured to present the information in a column format similar to the code section to which they apply. Other annexes or appendices provide information and materials intended to be helpful to the user such as model forms that can be used, recreational water illness outbreak response guidelines, and guidelines for facility inspection.

Appendices

Additional information that falls outside the flow of the annex may be included in the Model Aquatic Health Code Annex.

Acronyms in this Module: See the Facility Maintenance and Operation Module, Code Section

Glossary Terms in this Module: See the Facility Maintenance and Operation Module, Code Section

Preface: *This document does not address all health and safety concerns, if any, associated with its use. It is the responsibility of the user of this document to establish appropriate health and safety practices and determine the applicability of regulatory limitations prior to each use.*

Model Aquatic Health Code
5.0 Maintenance and Operation
Facility Maintenance and Operation Module Annex

<i>Keyword</i>	<i>Section</i>	<i>Annex</i>
	5.0	Facility Maintenance and Operation
	5.4	Recreational Water Venue Operations and Facility Maintenance
	5.4.1	Closure and Reopening
<i>Short Closures</i>	5.4.1.1	Short Closures
<i>Short Closures</i>	5.4.1.1.1	<p>It is important for the operator to be aware that when closed for even short periods of time, the venue distribution system, including drinking fountains and other potable water sources, may become stagnated. It is important to adequately ensure that all features should be adequately flushed and disinfected prior to reopening.</p> <p>Standing water, including closed swimming pools, can be a source of mosquitoes if disinfection is halted. Although mosquitoes can carry many diseases such as dengue fever, malaria, and encephalitis, one of the most common mosquito-borne infections in the US is due to West Nile virus which can cause fever and encephalitis. One study demonstrated a link between abandoned residential swimming pools, increases in mosquitos, and West Nile virus infections¹. Swimming pools should be disinfected to prevent them from becoming public nuisance issues as mosquito breeding areas or safety concerns.</p> <p>Additionally, closed pools can be a safety concern, especially for small children. When the pool is not drained or covered tightly to prevent entry, children may knowingly or accidentally enter the pool and drown. Because of the slime that often builds on the wall of these abandoned</p>

¹ Reisen WK, Takahashi RM, Carroll BD, Quiring R. Delinquent mortgages, neglected swimming pools, and West Nile virus, California. *Emerg Infect Dis.* 2008;14(11):1747-9.

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		<p>pools, it may be impossible for those that enter the pool to climb out. Abandoned pools may also have limited visibility so people falling in cannot be seen by other persons in the area.</p> <p>While fence barriers or safety covers can create a “safe condition” for the pool, these methods will not prevent the potential mosquito problems mentioned above.</p>
Safe Condition	5.4.1.1.2	<p>The closing of an aquatic facility for less than seven days is considered a temporary closure. A closure of more than seven days is considered a long term closure. Both types of closure require certain maintenance activities when closing or reopening to ensure a safe environment for patrons.</p>
Long Closures	5.4.1.2	Long Closures
Drain / Cover	5.4.1.2.1	<p>Pools that use a cover should refer to ASTM F1346-91. For pools where covers are not used or are not practical, access should be restricted and routine check of fence integrity is advised.</p> <p>ASTM F1346 – 91: Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs establishes requirements for safety covers for swimming pools, spas, hot tubs, and wading pools. When correctly installed and used in accordance with the manufacturer's instructions, this specification is intended to reduce the risk of drowning by inhibiting the access of children under five years of age to the water.</p> <p>For long term and seasonal closures, where no residual disinfectant is maintained in the pipes, further research is needed to understand the growth of biofilms during closure. More research is needed to develop protocols for removing biofilms in aquatic venues.</p> <p>If the aquatic venue system becomes non-operational, such as during a power outage, the venue should be cleared of bathers. Prior to reopening, the operator should confirm that all systems are operational as required by the MAHC. For example, recoating DE filters will be necessary and it</p>

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Reopening	5.4.1.2.1	<p>should be confirmed that feed pumps did not continue feeding chemicals during a recirculation system shutdown that may lead to outgassing into the pool when the system is re-started.</p>
Preventive Maintenance Plan	5.4.2	<p>Preventive Maintenance Plan</p> <p>A preventive maintenance plan is a necessary and important part of any pool operation. The best maintenance plan is one that follows the manufacturer’s and pool designer/engineer’s recommendations for all equipment.</p> <p>A pool maintenance plan is similar in many ways to the purchase of a new vehicle. With the purchase of a new vehicle, a manufacturer’s maintenance schedule is included. The schedule lists the maintenance items that should be followed such as rotating tires and performing major tune-ups.</p> <p>Likewise, the swimming pool operator should perform an inventory of all equipment used in the pool operation. For each piece of equipment the operator should develop a list and schedule of maintenance items. By following this maintenance schedule, the operator can help prevent costly repairs and breakdowns in the future. Replacing items before they breakdown may prevent system breakdowns that could lead to outbreaks or injuries. For example, a common breakdown leading to loss of disinfection is a break in the tubing leading from feed pumps to the recirculation system. Although inexpensive, lack of replacement has been implicated in outbreaks.</p> <p>Aquatic facilities need increased sophistication in plan maintenance and monitoring.</p>
Written Plan	5.4.2.1	Written Plan

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Facility Documentation	5.4.2.2	Facility Documentation
Equipment Inventory	5.4.2.2.2	<p>This inventory should contain information such as:</p> <ul style="list-style-type: none"> • Equipment name • Manufacture with contact information • Local vendor/supplier & technical representative • Model number • Horsepower, GPM, & filter size • Year of manufacture • Original cost • Warranty • Operating Manual • Equipment may be cataloged by area: <ul style="list-style-type: none"> ○ Deck ○ Lifesaving ○ Hygiene Facility ○ Filter System ○ Concession Stand ○ Aquatic Features
General Operations	5.4.3	General Operations
	5.5	Pool Structure (Shell)
	5.6	Indoor/Outdoor Environment
Lighting	5.6.1	Lighting
Lighting Maintained	5.6.1.1	Lighting Maintained
Light Levels	5.6.1.1.1	<p>System components will deteriorate and eventually need to be replaced, but lamp performance will continue to change prior to complete lamp failure. Indoor overhead lights, outdoor pole mounted lights, and underwater lighting are the key pool light sources. Building lighting must also be maintained to provide safe facility use, building and area security, and meet the aesthetic goals. Planned lighting maintenance includes group relamping, cleaning lamps, cleaning luminaires, and replacing defective components on a regular basis.</p> <p>Lamp lumen depreciation is a characteristic of all lamps.</p>

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		<p>Each lamp type has a different lamp life, thus impacting your maintenance schedule. As lamps fail or burn out, the local light levels are decreased and the lighting uniformity is also affected.</p> <p>Luminaire surface deterioration and dirt accumulation may also occur and can reduce the light reaching the needed areas. During relamping and cleaning, inspect each luminaire for deterioration or damage. Repair or replace components and inspect and clean light fixtures and luminaires as needed to maintain required light levels. Consider regular group relamping combined with cleaning as part of an efficient and effective maintenance plan.</p> <p>Basic steps for cleaning and relamping operations include first turning off electrical circuits and carefully removing lenses, diffusers, shields and/or lamps. Dispose of replaced lamps and ballasts per state and federal guidelines. Contact the U.S. EPA for more information. Follow the light fixture and lamp manufacturer’s recommendations for cleaning, relamping and maintaining each light in good condition. Routinely monitor underwater lights for proper operation.</p> <p>Windows and natural lighting need to be evaluated seasonally and throughout the operating day.</p> <p>Light levels may also be altered by dirty windows. Ensure that windows are cleaned regularly to eliminate any buildup of material that would affect light transmission.</p>
<i>Main Drain Visible</i>	5.6.1.1.2	<p>The requirement for being able to see the main drain from poolside is a safety issue. If lifeguards or operators cannot see the main drain then they are unable to see a person on the bottom of the aquatic venue and unable to initiate rescue procedures. This is cause for immediate closure and rectification before re-opening. Please refer to the MAHC Regulatory Module Provisions Section 6.6.4 for more information.</p>
<i>Glare</i>	5.6.1.2	<p>Glare</p> <p>In addition to discomfort, annoyance interference, and eye fatigue, glare reduces the visibility of an object. Without</p>

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		clear vision, there are increased chances for accidents that can cause injuries or potential drowning. Glare can be from reflections as well as direct lighting problems.
<i>Assessments</i>	5.6.1.2.1	Operator may consider adjusting guard positions to improve visibility.
<i>Ventilation</i>	5.6.2	Ventilation
<i>Maintenance and Repair</i>		Drains on air-handling equipment should be tested before the system is started. It is important that the drain system be checked regularly to ensure that the condensate drain pan, drain connection, and piping are free from buildup or blockages. In cases where air handling equipment is intended for use with P-trap type drains, the P-trap must be kept filled manually if normal operation does not keep the P-trap filled. If not kept filled, sewer gases, and odors can enter the system.
<i>Electrical</i>	5.6.3	Electrical
<i>Electrical Repairs</i>	5.6.3.1	Electrical Repairs
<i>Overhead Wiring</i>	5.6.3.1.2	National Electrical Code Article 225 provides installation requirements for outside branch circuits and feeders that run on (or between) structures or poles. National Electrical Code Article 680 applies to the construction and installation of electrical wiring for and equipment in or adjacent to all swimming, wading, therapeutic, and decorative pools; fountains; hot tubs; spas; and hydromassage bathtubs, whether permanently installed or storable, and to metallic auxiliary equipment, such as pumps, filters, and similar equipment.
<i>Electrical Receptacles</i>	5.6.3.2	Electrical Receptacles
<i>Repairs</i>	5.6.3.2.2	NEC Article 680.22 “General Circuitry Pool Pump Motors” states that “all 15- and 20-amp, single-phase, 125-volt or 240-volt outlets supplying pool pump motors shall have GFCI protection.” 29 C.F.R. 1910.304 “Wiring Design and Protection” applies

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		to temporary wiring installations that are used during construction-like activities, including certain maintenance, remodeling, or repair activities, involving buildings, structures or equipment.
<i>Ground Fault Circuit Interrupter</i>	5.6.3.3	<i>Ground-Fault Circuit Interrupter</i>
<i>Manufacturer's Recommendation</i>	5.6.3.3.1	<p>GFCI testing should follow the manufacturer's recommendations. However, the minimum test procedure should include:</p> <ul style="list-style-type: none"> • Testing personnel must wear shoes during the entire test. Where exposed terminals may be present, or where conditions warrant, other personal protective equipment may be required. • A suitable indicating test load should be connected to the circuit under test, and remain so for the duration of the test. • Test personnel should press the TEST button on the GFCI device. • The test load should then be observed to have ceased operation due to loss of electrical power. • Test personnel should next press the RESET button on the GFCI device. • The test load should then be observed to have resumed operation. • Where any of the conditions specified in steps (b) through (g) fail, the GFCI circuit must then be inspected and tested by a qualified person. Replace the GFCI device as necessary. <p>Pool chemicals, fertilizers, salt, oxidizing cleaning materials, and other corrosive materials should not be stored in any interior space containing electric light fixtures, panel boards, fuses, circuit breakers, disconnects, motors, motor overloads, bonding conductors, or similar devices.</p> <ul style="list-style-type: none"> • Exception (a): Otherwise approved chemical storage

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spaces having light fixtures which are approved for use in corrosive atmospheres, and which serve the chemical storage space only, should be acceptable.

- Exception (b): Otherwise approved chemical storage spaces having a light switch or switches approved for use in corrosive atmospheres, and which serve the chemical storage space only, should be acceptable.
- Exception (c): Otherwise approved chemical storage spaces containing small motors and the associated controllers, such as those for exhaust-blowers and peristaltic pumps should be acceptable where such motor circuits are protected by GFCI.
- Exception (d): Otherwise approved chemical storage spaces containing devices listed and labeled for use in interior pool-chemical storage spaces should be acceptable.
- Exception (e): Otherwise approved chemical storage spaces containing devices listed and labeled for use in corrosive atmospheres should be acceptable where approved by the AHJ.

Flammable liquids and flammable gases should not be stored in any interior space containing electric light fixtures, panel boards, fuses, circuit breakers, disconnects, motors, motor overloads, bonding conductors, or similar devices, unless such devices comply with Article 500 of the NEC, or with the relevant local codes.

Pool chemicals, acids, and fertilizers, salt, oxidizing cleaning materials and other corrosive or oxidizing chemicals should not be stored in interior spaces where electrical conduits enter or pass through the space.

- Exception (a) Otherwise approved chemical storage spaces into which conduits enter or pass through should be acceptable, where such conduits (i) are sealed where they enter and exit the storage space, and (ii) are listed as corrosion resistant, and (iii) serve only approved loads in the storage space itself.
- Exception (a) Otherwise approved chemical storage spaces containing conduits approved for use in corrosive atmospheres should be acceptable if approved by the AHJ.

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Where an interior space was previously approved for storage of pool chemicals, acids, fertilizers, salt, oxidizing cleaning materials, other corrosive or oxidizing chemicals, or flammable liquids or gases and will continue to be used for such storage, any replacement electrical parts or devices should be of the same type as the original equipment, or should be listed and labeled for such use.

No new electrical devices or equipment should be installed in an interior storage space used for storage of pool chemicals, acids, fertilizers, and salt, oxidizing cleaning materials, or flammable liquids or gases without re-inspection by the AHJ.

An interior storage space used for storing pool chemicals, fertilizers, salt, oxidizing cleaning materials, other corrosive or oxidizing chemicals, or pesticides must be kept in isolation from other interior spaces, except for entry, egress, material transport, or alarm testing. The period of each instance of entry, access, or alarm testing should not exceed 15 minutes. The sum of the periods of all instances of breach of isolation should not exceed 1 hour in each 24-hour period.

Where the isolation of an interior storage space containing such chemicals from other interior spaces containing combustion devices depends on an interior door, such door should be gasketed to prevent the passage of air, fumes, or vapors, and should be equipped with an automatic door closer and an alarm that will give notice if the door remains open for more than five minutes. Function of this alarm should be confirmed monthly as part of scheduled maintenance. Failures of door gasketing, or of the door closer, or of the alarm should be repaired immediately.

Where any unsealed openings exist between an interior storage space used for pool chemicals, acids, fertilizers, salt, or corrosive or oxidizing chemicals and any other interior space containing electrical equipment, the air pressure in the chemical storage space should be maintained at a level low enough to insure that all air flow should be toward the chemical storage space. This pressure difference should be maintained by a continuously operating exhaust system used for no other purpose than to

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		<p>remove air from the chemical-storage space. Function of this exhaust system should be monitored continuously by a pressure switch and alarm. Function of the pressure switch and alarm should be confirmed monthly as part of scheduled maintenance. In the event of failure of the exhaust system or of the alarm, repairs should be done immediately.</p> <p>In any space containing electrical equipment, ambient conditions such as temperature, humidity, and maximum concentrations of chemical fumes or vapors, or of flammable fumes or vapors should be continuously maintained to meet the operational requirements of installed electrically powered equipment.</p> <p>Labels or other marks indicating the circuits served by fuses, circuit breakers, and disconnect switches should be maintained in a condition readable by a person unfamiliar with the function of the circuits.</p> <p>For spaces containing fuses, circuit breakers, electric motors, or motor-operated loads, the recommended minimum illumination capability should be maintained as part of the scheduled monthly maintenance. Storage should not interfere with the largest of the minimum working clearances specified by the NEC, the equipment manufacturer, CFR 1910, or by local codes or regulations.</p> <p>Re-lamping operations within 20 feet horizontally of the nearest inside edge of a pool, spa, flume, water slide or other open aquatic feature should be carried out in such a way as to minimize the likelihood of lamp breakage. New lamps should be kept in their packing until just before installation. Old lamps should be packed immediately upon removal into a suitable container to prevent breakage. New lamps should not be stored in an interior storage space used for pool chemicals, fertilizers, salt, or other corrosive or oxidizing chemicals. Neither new lamps nor old lamps should be stored in the natatorium, shower room, locker room, or hallways.</p> <p>Where visible or accessible, any required bonding jumpers should be visually inspected for damage, breaks, looseness, or corrosion quarterly as part of scheduled maintenance. Where any doubt exists concerning the condition of bonding jumpers, a qualified person should</p>

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		inspect and, if necessary, test the effectiveness of such jumpers.
	5.6.3.4	<i>Grounding</i>
<i>Grounding</i>		<p>The purpose and objective of NEC Article 250 - Grounding is to insure that the electrical system is safe against electric shock and fires by limiting the voltage imposed by lightning, line surges, or unintentional contact with higher-voltage lines and a <i>ground-fault (line-to-case fault)</i>. The rules contained in Article 250 identify the installation methods that must be followed to insure a safe electrical installation.</p> <p>National Electrical Code Article 680 applies to the construction and installation of electrical wiring for and equipment in or adjacent to all swimming, wading, therapeutic, and decorative pools; fountains; hot tubs; spas; and hydromassage bathtubs, whether permanently installed or storable, and to metallic auxiliary equipment, such as pumps, filters, and similar equipment.</p>
<i>Bonding</i>	5.6.3.5	<i>Bonding</i>
<i>Extension Cords</i>	5.6.3.6	<i>Extension Cords</i>
<i>Exception</i>	5.6.3.6.3	The intent is to prevent the extension cord from reaching the water.
<i>Compliance</i>	5.6.3.6.6	See CFR 1910.304 (b)(2)– http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9881
<i>Portable Electrical Devices</i>	5.6.3.7	<i>Portable Electric Devices</i>
<i>Communication Devices</i>	5.6.3.8	<i>Communication Devices and Dispatch Systems</i>
		<p>National Electrical Code Article 800 covers multi-purpose and communication cable. Multi-purpose cable is the highest listing for a cable and can be used for communication, Class 2, Class 3, and power-limited fire protective cable. Communication cable can be used for Class 2 and Class 3 cable and also as a power-limited fire protective cable with restrictions.</p>

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<i>Facility Heating</i>	5.6.4	Heating
<i>Facility Heating</i>	5.6.4.1	Facility Heating
<i>Maintenance and Repair</i>	5.6.4.1.1	There are a number of codes which can be consulted. These include but are not limited to the national fuel gas code, national electrical code, and certain building codes.
<i>Defects</i>	5.6.4.1.2	If inspection shows excessive fouling of air filters before the cleaning or replacement period has ended, that period should be reduced to prevent overloading of filters. Filters that become clogged with dirt, mold, or other contaminants can become a source of increased operating costs and poor air circulation. In addition to the reduction of system effectiveness, which can result in costly repairs, air-borne contaminants can be spread as a result of improper air handling.
<i>Temperature</i>	5.6.4.1.3	The air temperature of an indoor aquatic venue should be controlled to the original specifications where possible. Where this is not possible, the air temperature of a natatorium should be controlled so as to prevent unexpectedly high levels of evaporation and to prevent condensation of water onto surfaces not designed for condensation. Particular care should be taken to prevent the condensation of water inside indoor aquatic venue building surfaces such as walls and ceilings. Please note that this code only looks at the part of the facility where the water “vessel” is located and not at other areas of buildings (the building code would cover). Particular attention needs to be given to the prevention of algae and mold growth on surfaces.
<i>Pool Water Heating</i>	5.6.4.2	Water Heating
<i>First Aid Room</i>	5.6.5	First Aid Room
<i>Emergency Exit</i>	5.6.6	Emergency Exit
<i>Plumbing</i>	5.6.7	Plumbing
<i>Water Supply</i>	5.6.7.1	Water Supply

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<i>Availability</i>	5.6.7.1.2	The potable water pressure should be maintained to enable the pool and all other water using fixtures to operate to design specifications.
<i>Drinking Fountains</i>	5.6.7.2	<i>Drinking Fountains</i>
<i>Waste Water</i>	5.6.7.3	<i>Waste Water</i>
<i>Waste Water</i>		In some aquatic facilities, backwash water may be recycled for other purposes instead of wasted in order to conserve water. This water must be treated in accordance with local code requirements prior to being re-used. Backwash water is likely to be routinely contaminated with pathogens so its use should be carefully considered and health issues planned for prior to re-use. It should not be re-used in aquatic venues, but may be used in landscaping or other non-potable water uses.
<i>Solid Waste</i>	5.6.8	<i>Solid Waste</i>
<i>Storage Receptacles</i>	5.6.8.1	<i>Storage Receptacles</i>
<i>Disposal</i>	5.6.8.2	<i>Disposal</i>
<i>Decks</i>	5.6.9	<i>Decks</i>
<i>Food & Drink</i>	5.6.9.1	<i>Food Preparation and Consumption</i>
<i>Patrons</i>	5.6.9.1.2	Eating and drinking in aquatic venue areas may expose bathers to contaminants. Food particles that fall into the pool not only contribute to contamination burden, but may also affect pool disinfection. Additionally, contamination can occur through ingestion. Alcohol increases urine output and therefore creates more chloramines and other disinfection by-products if bathers do not regularly get out of the pool to urinate. Regular bathroom breaks should be considered to reduce urination in the aquatic venue that allows designated areas like “swim-up bars” that may increase pool urination and create compliance issues with MAHC combined chlorine levels. However, at this time, the MAHC does not have data suggesting that aquatic venues containing “swim up bars” have any more issues with water quality compliance issues that those venues that do not. Venues considering “swim-up” bars need to be aware that

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		<p>these areas may also increase the risk of drowning caused by excessive alcohol consumption and should include this thinking in lifeguard training and in-service training.</p> <p>Currently the majority of states do not allow swim up bars; however, Ohio, Hawaii, Texas, and a few local jurisdictions do, mostly in resort areas. The MAHC defers to local jurisdictions to assess and determine potential risks.</p> <p>Another topic that should be mentioned is nursing mothers and safety risk to babies. While many mothers consider nursing in the pool a pleasant experience for the baby there is a definite safety risk for the baby to potentially ingest contaminated pool water that may contain organisms such as <i>Cryptosporidium</i>. See CDC Healthy Swimming discussion at http://www.cdc.gov/healthywater/swimming/pools/breastfeeding-in-pools.html</p>
<i>Glass</i>	5.6.9.2	<i>Glass</i> <p>Glass is prohibited in the pool deck area to prevent injuries to patrons. Most bathers are bare foot, so stepping on glass can cause serious injuries. If a glass container breaks in the pool vicinity it could potentially fall into the pool water. Clear glass is virtually invisible in water and is difficult to remove. The only way to ensure all broken glass is removed from pool water is to thoroughly drain and clean the pool structure. Depending on the size, draining and cleaning a pool can cost thousands of dollars.</p>
<i>Deck Maintenance</i>	5.6.9.3	<i>Deck Maintenance</i>
<i>Free from Obstructions</i>	5.6.9.3.1	<p>Decks should always be kept clear of obstructions to preserve space that may be needed for rescue efforts. Obstructions also cause tripping hazards and can lead to falls and serious injuries. Attention must also be given to potential fall hazards from slippery deck areas.</p>
<i>Vermin</i>	5.6.9.3.3	<p>It is important to maintain these areas free from debris, vermin, and vermin harborage. Animals can carry diseases which could be transmitted through bites or contact with bodily fluids or feces.</p>

<i>Keyword</i>	<i>Section</i>	<i>Annex</i>
<i>Original Design</i>	5.6.9.3.4	Proper maintenance of surfaces will help prevent abrasions to bathers and biofilm growth. Please see the following MMWR for more information ² .
<i>Aquatic Facility Maintenance</i>	5.6.10	Aquatic Facility Maintenance
<i>Diving Boards and Platforms</i>	5.6.10.1	Diving Boards and Platforms
<i>Slip-Resistant Finish</i>	5.6.10.1.1	This can be accomplished by ensuring that the coefficient of friction is greater than or equal to that specified in MAHC Section 4.8.1.4.
<i>Steps / Guardrails</i>	5.6.10.2	Steps and Guardrails
<i>Starting Blocks</i>	5.6.10.3	Starting Blocks
<i>Deck Slides</i>	5.6.10.4	Deck Slides
<i>Fencing</i>	5.6.10.5	Fencing and Barriers
<i>Aquatic Facility Cleaning</i>	5.6.10.6	Aquatic Facility Cleaning
		In-pool cleaning systems must be periodically inspected to make sure they retract and stay flush with the floor.
	5.7	Recirculation and Water Treatment
	5.8	Decks and Equipment
	5.9	Filter and Equipment Room
	5.10	Hygiene Facilities
	5.11	Water Supply/ Wastewater Disposal
<i>Specific Venues</i>	5.12	Specific Venues, Special Requirements
<i>Slides</i>	5.12.1	Water Slides
<i>Wave Pools</i>	5.12.2	Wave Pools
<i>Moveable Floors</i>	5.12.3	Moveable Floors

² CDC. An outbreak of *Pseudomonas* folliculitis associated with a waterslide – Utah. MMWR Morb Mortal Wkly Rep. 1983;32(32):425-7.

<i>Keyword</i>	<i>Section</i>	<i>Annex</i>
<i>Bulkheads</i>	5.12.4	Bulkheads
<i>Spraygrounds</i>	5.12.5	Spraygrounds
<i>Wading Pools</i>	5.12.6	Wading Pools

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Model Aquatic Health Code Facility Maintenance and Operation Module 6.0 Policies and Management

Keyword	Section	Annex
<i>Policies and Management</i>	6.0	Policies and Management
<i>Facility Management</i>	6.4	Facility Management
<i>Operations</i>	6.4.1	Operations
<i>Operations Manual</i>	6.4.1.1	<i>Operations Manual</i>
<i>Develop</i>	6.4.1.1.1	The facility design consultant can provide valuable assistance with preparation of a manual based on their knowledge of the physical system. The facility owner/operator must provide their preferences for operation and maintenance activities, based on location, climate, programs, budget, etc.
<i>Include</i>	6.4.1.1.2	A manual for the operation of aquatic facilities should be kept at the facility, in both printed and digital formats. The manual should include basic information, chemical data, and operation and maintenance instructions about each pool, spa and spray ground feature at the facility. The manual should be updated on a regular basis to include added features, renovation work, and new code requirements.
<i>Safety Related Info</i>		<p>Patron and staff safety are paramount to responsible operation of an aquatic facility. Provide safety related information in the operations manual including, but not limited to the following:</p> <ul style="list-style-type: none"> • Diving, drowning and electrocution hazards and risk reduction procedures • Safety signage locations and message information • Chemicals (type and quantity stored, MSDS information, delivery procedures) • Chemical safety equipment and procedures • Emergency procedures for staff • Emergency procedures for patrons • Inventory of patron safety equipment (first aid kit, back

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board, head restraints, rescue tubes, throw ropes, rescue pole, etc.)

- Fire safety equipment locations, operation and Public Safety Department notification plan (fire extinguishers, hydrants, sprinkler system)
- Staff training and practice drill schedule and procedures
- Electrical system, controls, and GFCI's
- Lighting and ventilation system description and controls
- Vehicle and pedestrian accessibility
- Lightning and storm evacuation plan
- Emergency phone location and access
- Emergency plan for evacuation and area notification
- Maintain an injury log

Aquatic Feature
Info

Key criteria for each aquatic feature should be summarized including, but not necessarily limited to the following:

- Basin materials (wall and floor structures, gutter system)
- Coating materials
- Flotation protection (underdrain system, sump pump, hydrostatic relief valves, etc.)
- Surface area (square feet of water or wet deck for spray grounds)
- Volume (gallons)
- Turnover period (turnovers per day)
- Recirculation rate (gallons per minute)
- Filter loading rate (gallons per minute per square foot of filter surface area)
- Special features flow rates (gallons per minute for slides, sprays, lazy rivers, current channels, vortex areas, surf features, play features, etc.)

Chemical Data

The operations manual should also provide chemical data for each chemical system in the facility. This includes but is not necessarily limited to the following:

- Description of chemicals provided for primary disinfectant, pH adjustment, alkalinity adjustment,

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Keyword	Section	Annex
Facility Operation Info		<p>stabilizer, superchlorination, coagulant, filter aid, etc.</p> <ul style="list-style-type: none"> • Secondary disinfection system description, if provided (UV, ozone, other) • Type of chemical feed equipment and rated capacities • Discussion of water treatment goals and range of chemical targets • Description of chemical testing equipment • Testing frequency and location for each test • Chemical controller information, probe cleaning and calibration procedures • Water testing log forms for chemical results • Chemical supplies (storage quantity, providers, safety procedures)
		<p>The operations manual should also provide instructions for aquatic facility operations. These instructions should include, but not necessarily be limited to the following:</p> <ul style="list-style-type: none"> • Filter backwash or cleaning schedule and procedure • Periodic vacuuming and cleaning schedule and procedures • Seasonal cleaning procedures Superchlorination basis and procedure • Controller sensor maintenance (if applicable) • Preventative maintenance tasks and schedule • Winterizing procedures • Start-up and closing procedures
Maintenance Instructions		<p>The operations manual should provide instruction for proper maintenance for the facility. Both daily and seasonal or periodic maintenance will be required for your aquatic facility. Available time and budget must always be balanced with the maintenance need. Regardless of whether your facility is large or small, frequent maintenance is more effective and more efficient than waiting until a larger problem occurs.</p> <ul style="list-style-type: none"> • Provide an inventory of available maintenance equipment and materials. • Develop a daily maintenance schedule. • Develop a schedule for periodic or seasonal maintenance. • Create a maintenance log with date and activity for

Keyword	Section	Annex
Office Management	future planning and budgeting.	<p>The operations manual also provides office management information for the facility. This manual should include, but not be limited to following:</p> <ul style="list-style-type: none"> • Active and inactive records and general file information • Forms for water test results and filter cleaning frequency • Forms for inventory of chemicals, equipment, cleaning supplies, etc. • Maintenance inspection forms for facility, equipment and structures • Maintenance work forms • Requisition forms for purchasing based on facility policies • Staff evaluation forms log • Pool operation log (water quality, attendance, weather, open hours, injuries, complaints, equipment issues, etc.) • Security (opening and closing, underwater lighting, overhead lighting, doors, windows, alarms, bank deposits, etc.).
Personnel Records	<p>Accurate records should be maintained for all personnel.</p> <p>The options for this category are varied and numerous. The following list of personnel items is offered as an outline and a starting point for developing an operations manual including, but not limited to the following:</p> <ul style="list-style-type: none"> • Staff qualifications and job descriptions • Payroll procedures • Facility policies • Schedules and work attendance • Vacation and sick leave • Benefits • Conferences and education Training programs • Termination basis • Accident prevention 	

Keyword	Section	Annex
Budget Considerations		<p>An accurate and feasible budget is critical for ongoing aquatic facility operation. Budget considerations should be included, but not limited to the following:</p> <ul style="list-style-type: none"> • Program fees and policies • Rental rates and policies • Staff wages and benefits • Facility expenditures for utilities, chemicals, concession supplies, equipment, training and program supplies, repairs and maintenance, insurance and office administration. • Financial report including monthly and annual summaries, projections and trends.
System Check Program	6.4.1.2	<i>System Check Program</i>
Recordkeeping	6.4.1.3	<i>Recordkeeping</i>
Schedule	6.4.1.3.1	<p>Testing results of any scheduled maintenance, inspections or system checks. These may include alarm testing, GFCI tests, diving board inspections and bonding continuity checks.</p>
Monitoring and Testing Records	6.4.1.3.3	<p>These duties include but are not limited to:</p> <ul style="list-style-type: none"> • Measure and record (or supervise and ensure the measurement and recording of) all information as required by MAHC operations, testing, monitoring, and reporting requirements. • Maintain the filtration and recirculation system as required to maintain minimum flow rates required by MAHC 4.7.1. • Backwash the filtration system when the filter gauge pressure differential reaches a level specified by the equipment manufacturer or as specified in the MAHC 4.7.2. • Maintain disinfectant residuals according 4.7.3; • Maintain water chemistry according to MAHC 5.7.3;

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- Monitor water temperature to ensure it is within range specified in MAHC Section 4.7.3.
- Clean accessible pool surfaces as necessary to remove slime/biofilm accumulation.
- 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.
- Add replacement water as needed to meet all MAHC requirements.
- Ensure hygiene facilities are clean, sanitary, and supplies needs for swimmer hygiene such as toilet paper and soap or hand sanitizer are available for use as per Section 5.10.10 of the MAHC.

Injury/Incident Report

6.4.1.3.6

For more information on the Virginia Graeme Baker Pool and Spa Safety Act, please see:

<http://poolsafely.gov/state-local-officials/pool-spa-safety-act-requirements/>

Also see the CPSC Staff guidance in interpreting the act at: <http://poolsafely.gov/pool-spa-safety-act/interpretations-guidelines/>

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Keyword	Section	Annex
<i>Body Fluid Release Log</i>	6.4.1.3.7	See MAHC Fecal Vomit and Blood Provisions in Section 6.5 for specific standards. For the CDC protocol for cleaning body fluid spills from pool decks, see the document entitled “Cleaning up Body Fluid Spills on Pool Surfaces” which can be found on the CDC Healthy Swimming/Recreational Water website at http://www.cdc.gov/healthywater/swimming/pools/cleaning-body-fluid-spills.html . A sample body fluid contamination response log can be found with the Fecal Vomit and Blood Provisions in Section 6.5

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A Note about Resources

The resources used in all MAHC modules come from peer-reviewed journals and government publications. No company-endorsed publications have been permitted to be used as a basis for writing code or annex materials.

Bibliography

The Annex includes a listing of CODES that are referenced and a bibliography of the scientific reference materials and studies that form the basis for recommendations.

Codes Referenced in this Module

ASTM F1346 – 91: Standard Performance Specification for Safety Covers and Labeling Requirements for All Covers for Swimming Pools, Spas and Hot Tubs

National Electrical Code Article 800

National Electrical Code Article 225

National Electrical Code Article 680

NEC Article 680.22 “General Circuitry Pool Pump Motors

29 C.F.R. 1910.304 “Wiring Design and Protection”

Article 500 of the NEC

NEC Article 250 – Grounding

References Cited in this Module

CDC. An outbreak of *Pseudomonas* folliculitis associated with a waterslide – Utah. MMWR Morb Mortal Wkly Rep. 1983;32(32):425-7.

Reisen WK, Takahashi RM, Carroll BD, Quiring R. Delinquent mortgages, neglected swimming pools, and West Nile virus, California. Emerg Infect Dis. 2008;14(11):1747-9.

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