

Model Aquatic Health Code

Facility Maintenance and Operation Annex Section for the First 60-day Review

**Posted for Public Comment on 10/31/2011
Currently Open for Public Comment that Closes on 12/29/2011**

In an attempt to speed the review process along, the MAHC steering committee has decided to release MAHC draft modules prior to their being fully complete and formatted. These drafts will continue to be edited and revised while being posted for public comment. The complete versions of the drafts will be available for public comment again when all MAHC modules are posted for final public comment. 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.

MAHC Facility Maintenance and Operation Module Review Guidance

The [Model Aquatic Health Code \(MAHC\) Steering](http://www.cdc.gov/healthywater/swimming/pools/mahc/steering-committee/) (<http://www.cdc.gov/healthywater/swimming/pools/mahc/steering-committee/>) and [Technical Committees](http://www.cdc.gov/healthywater/swimming/pools/mahc/technical-committee/) (<http://www.cdc.gov/healthywater/swimming/pools/mahc/technical-committee/>) appreciate your willingness to review this draft MAHC module. Your unique perspectives and science-based suggestions will help ensure that the best available standards and practices for protecting aquatic public health are available for adoption by state and local environmental health programs.

Review Reminders:

- Please download and use the [MAHC Comment Form](http://www.cdc.gov/healthywater/swimming/pools/mahc/structure-content/) (<http://www.cdc.gov/healthywater/swimming/pools/mahc/structure-content/>) to submit your detailed, succinct comments and suggested edits. Return your review form by December 29, 2011, as an email attachment to MAHC@cdc.gov.
- If part of a larger group or organization, please consolidate comments to speed the MAHC response time to public comments.
- To provide context for this module review, please consult the [MAHC Strawman Outline](http://www.cdc.gov/healthywater/pdf/swimming/pools/mahc/structure-content/mahc-strawman.pdf) (<http://www.cdc.gov/healthywater/pdf/swimming/pools/mahc/structure-content/mahc-strawman.pdf>). Section headers of related content have been included in this draft module to assist reviewers to see where each section fits into the overall MAHC structure. Additional MAHC draft modules that contain this content will be or already have been posted for your review.

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- MAHC Grading System
 - A grading system is provided for the recommended standards. It is based on the perceived reliability and accuracy of the material presented. This grading system is divided into three levels. The MAHC grading system is as follows:
 - Grade A: Practice supported by science/research/data.
 - Grade B: Generally accepted practice not supported by science/research/data.
 - Grade C: No generally accepted practice. Proposed language not yet supported by science/research/data.
- 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 published MAHC will be regularly updated through a collaborative all-stakeholder process.

Please address any questions you may have about MAHC or the review process to MAHC@cdc.gov. You may also request to be on the direct email list for alerts (“Get Email Updates” is in a box on the right hand side of the Healthy Swimming website at www.cdc.gov/healthyswimming) on the other draft MAHC modules as they are released for public comment.

Thank you again, and we look forward to your help in this endeavor.
Sincerely,

Douglas C. Sackett, Director
MAHC Steering Committee

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>).

Reviewer Note on Module Section Numbering:

Please use the specific section numbers to make your comments on this Draft Model Aquatic Health Code module. These numbers may eventually change during the editing of the compiled Draft that will be issued for a final round of comments.

Reviewer Note on the MAHC Annex

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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 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 Hygiene 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>Long and Short Closures</i>	5.4.1.1	<i>Long and Short Closures</i>
<i>Safe Condition</i>	5.4.1.1.1	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.
<i>Drain / Cover</i>	5.4.1.1.2	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. 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

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		<p>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>
<i>Short Closures</i>	5.4.1.1.4	<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. Although mosquitoes can carry many diseases such as dengue fever, malaria, and encephalitis, one of the most common diseases today is the West Nile encephalitis.</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 pools, it may be impossible for those that enter the pool to climb out.</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>
	5.4.1.1.4	<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.</p>

Reopening

5.4.1.2

Reopening

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<i>Criteria</i>	5.4.1.2.1	The operator should refer to previous inspection reports for more details on repairs or replacements needed, and any replacements or new items should be discussed with the regulatory authority to verify they comply with current code requirements. It is recommended that a model Reopening Checklist be developed in the future.
<i>Preventive Maintenance Plan</i>	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, and manufacturer’s maintenance schedule is included. The schedule list the maintenance items that should be followed such as rotating tires changing all 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 in the future.</p> <p>Aquatic facilities need increased sophistication in plan maintenance and monitoring.</p>
<i>Facility Documentation</i>	5.4.2.2	<p>Facility Documentation</p>
<i>Equipment Inventory</i>	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

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- Original cost
- Warranty
- Operating Manual
- Equipment may be cataloged by area:
 - Deck
 - Lifesaving
 - Bath House
 - Filter System
 - Concession Stand
 - Aquatic features

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**

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.

Lamp lumen depreciation is a characteristic of all lamps. 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.

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

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		<p>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>
Main Drain Visible	5.6.1.1.2	<p>In addition to discomfort, annoyance interference, and eye fatigue, glare reduces the visibility of an object. Without 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.</p>
	5.6.2	Ventilation
Electrical	5.6.3	Electrical
Electrical Repairs	5.6.3.1	Electrical Repairs
Overhead Wiring	5.6.3.1.2	<p>National Electrical Code Article 225 provides installation requirements for outside branch circuits and feeders that run on (or between) structures or poles.</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</p>

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		installed or storable, and to metallic auxiliary equipment, such as pumps, filters, and similar equipment.
<i>Electrical Receptacles</i>	5.6.3.2	<i>Electrical Receptacles</i>
<i>Repairs</i>	5.6.3.2.2	<p>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.”</p> <p>29 C.F.R. 1910.304 “Wiring Design and Protection” applies to temporary wiring installations that are used during construction-like activities, including certain maintenance, remodeling, or repair activities, involving buildings, structures or equipment.</p>
<i>Ground Fault Circuit Interrupter</i>	5.6.3.3	<i>Ground-Fault Circuit Interrupter</i>
<i>Manufacturer’s Recommendations</i>	5.6.3.3.1	<p>GFCI testing shall follow the manufacturer’s recommendations. However, the minimum test procedure shall include:</p> <ol style="list-style-type: none"> a) 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. b) A suitable indicating test load should be connected to the circuit under test, and remain so for the duration of the test. c) Test personnel should press the TEST button on the GFCI device. d) The test load should then be observed to have ceased operation due to loss of electrical power. e) Test personnel should next press the RESET button on the GFCI device. f) The test load should then be observed to have resumed operation.

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- g) 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.

Pool chemicals, fertilizers, salt, oxidizing cleaning materials, and other corrosive materials shall 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.

Exception (a): Otherwise approved chemical storage spaces having light fixtures which are approved for use in corrosive atmospheres, and which serve the chemical storage space only, shall 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, shall 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 shall 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 shall be acceptable.

Exception (e): Otherwise approved chemical storage spaces containing devices listed and labeled for use in corrosive atmospheres shall be acceptable where approved by the AHJ.

Flammable liquids and flammable gases shall 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

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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 shall 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 shall 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 shall be acceptable if approved by the AHJ.

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 shall be of the same type as the original equipment, or shall be listed and labeled for such use.

No new electrical devices or equipment shall 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 shall not exceed 15 minutes. The sum of the periods of all instances of breach of isolation shall not exceed 1

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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 shall be gasketed to prevent the passage of air, fumes, or vapors, and shall 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 shall be confirmed monthly as part of scheduled maintenance. Failures of door gasketing, or of the door closer, or of the alarm shall 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 shall be maintained at a level low enough to insure that all air flow shall be toward the chemical storage space. This pressure difference shall be maintained by a continuously operating exhaust system used for no other purpose than to remove air from the chemical-storage space. Function of this exhaust system shall be monitored continuously by a pressure switch and alarm. Function of the pressure switch and alarm shall be confirmed monthly as part of scheduled maintenance. In the event of failure of the exhaust system or of the alarm, repairs shall be done immediately.

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 shall be continuously maintained to meet the operational requirements of installed electrically powered equipment.

Labels or other marks indicating the circuits served by fuses, circuit breakers, and disconnect switches shall be maintained in a condition readable by a person unfamiliar with the function of the circuits.

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For spaces containing fuses, circuit breakers, electric motors, or motor-operated loads, the recommended minimum illumination capability shall be maintained as part of the scheduled monthly maintenance.

For spaces containing fuses, circuit breakers, electric motors, or motor-operated loads, storage shall 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.

Re-lamping operations within 20 feet horizontally of the nearest inside edge of a pool, spa, flume, water slide or other open aquatic feature shall be carried out in such a way as to minimize the likelihood of lamp breakage. New lamps shall be kept in their packing until just before installation. Old lamps shall be packed immediately upon removal into a suitable container to prevent breakage. New lamps shall 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 shall be stored in the natatorium, shower room, locker room, or hallways.

Where visible or accessible, any required bonding jumpers shall 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 shall inspect and, if necessary, test the effectiveness of such jumpers.

5.6.3.4

Grounding

Grounding

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 *ground-fault (line-to-case fault)*. The rules contained in Article 250 identify the installation methods that must be followed to insure a

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		safe electrical installation.
		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>Grounding Conductors</i>	5.6.3.4.2	Does the MAHC need to add an example to show what “minor repair” would limit?
	5.6.3.5	<i>Bonding</i>
<i>Electrical Repairs</i>	5.6.3.6	<i>Extension Cords</i>
	5.6.3.6.4	Add NEC language
	5.6.3.6.5	Add NEC language
<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
	5.6.3.7	<i>Portable Electric Devices</i>
	5.6.3.8	<i>Communication Devices and Dispatch Systems</i>
	5.6.4	<i>Heating</i>
<i>Facility Heating</i>		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>Facility Heating</i>	5.6.4.1	<i>Facility Heating</i>
<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 causes can become a source of increased operating costs and poor air circulation. In addition to the reduction of system

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		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 shall 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 “vessel” is and not other areas of buildings (building code would cover). Particular attention needs to be given to the prevention of algae and mold growth on the surfaces.
<i>Pool Water Heating</i>	5.6.4.2	Water Heating
<i>Maintenance and Repair</i>	5.6.4.2.1	Drains on air-handling equipment shall 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.
	5.6.5	First Aid Room
	5.6.6	Emergency Exit
<i>Plumbing</i>	5.6.7	Plumbing
<i>Water Supply</i>	5.6.7.1	Water Supply
<i>Availability</i>	5.6.7.1.2	The potable water pressure shall be maintained to enable the pool and all other water using fixtures to operate to

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		design specifications.
	5.6.7.2	<i>Drinking Fountains</i>
	5.6.7.3	<i>Waste Water</i>
<i>Waste Water</i>		<p>Add discussion about treatment of backwash water for reintroduction to the pool as a water conservation effort – still done in accordance to local building codes... as future potential code implementation</p> <p>In some venues backwash water may be recycled instead of wasted in order to conserve water. This water must be treated in accordance with local code requirements prior to being introduced back into the venue.</p>
	5.6.8	<i>Solid Waste</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	<p>Eating and drinking into areas may subject bathers to exposure 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. Some venues now have to consider “swim-up” bars which can also contribute to drowning caused by excessive alcohol consumption.</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 Cryptosporidium.</p>
	5.6.9.2	<i>Glass</i>
<i>Deck Maintenance</i>	5.6.9.3	<i>Deck Maintenance</i>
<i>Free from Obstructions</i>	5.6.9.3.1	Decks should always be kept clear of obstructions to preserve space that may be needed for rescue efforts.

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		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.
Vermin	5.6.9.3.4	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.
Original Design	5.6.9.3.5	Proper maintenance of surfaces will help prevent abrasions to bathers and biofilm growth. Please see the following MMWR for more information. http://www.cdc.gov/mmwr/preview/mmwrhtml/00000126.htm
Risk Management	5.6.9.3.9	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.
Aquatic Facility Maintenance	5.6.10	Aquatic Facility Maintenance
	5.6.10.1	Diving Boards and Platforms
	5.6.10.2	Steps and Guardrails
	5.6.10.3	Starting Blocks
	5.6.10.4	Deck Slides
	5.6.10.5	Fencing and Barriers
	5.6.10.6	Aquatic Facility Cleaning
Aquatic Facility Cleaning		Annex discussion in-pool cleaning system must be periodically inspected to make sure they retract and stay flush w the floor. Add more detail... pool cleaning systems – may include built-in in-suction fittings in the filtration system, floor, portable filter pumps (electric of gasoline powered), automatic (Aqua King?)...
		Add information to support daily disinfection (for example, studies regarding bacteria on deck surfaces) and/or differentiate between deck types that require disinfection) While it would be nice to be able to have daily disinfection of all decks, this would not really happen and there would be many, many violations to write up.

Public health data regarding reuse of backwash water is

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Keyword	Section	Annex
		lacking. Assume that water has a pathogen load in it. Discuss issue of recycling backwash water, and extra treatment (e.g. settling in a tank, membrane filtration, ozone, UV). Explain there is a movement toward reclaiming water for environmental and economic reasons and data is needed.

	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
Specific Venues	5.12	Specific Venues, Special Requirements

Model Aquatic Health Code Facility Maintenance and Operation Module

Keyword	Section	Annex
	6.0	Policies and Management
	6.4	Facility Management
	6.4.1	Operations
	6.4.1.1	<i>Operations Manual</i>
Operations	6.4.1.1	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.

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.

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:

- 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 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

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)

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- 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.)

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, stabilizer, superchlorination, coagulant, filter aid, etc.
- 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)

The operations manual should also provide instructions for aquatic facility operations. These instructions should include, but not necessarily be limited to the following:

- Filter backwash or cleaning schedule and procedure
- Periodic vacuuming and cleaning schedule and procedures
- Seasonal cleaning procedures Superchlorination basis and procedure

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- Controller sensor maintenance (if applicable)
- Preventative maintenance tasks and schedule
- Winterizing procedures
- Start-up and closing procedures

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.

- 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 future planning and budgeting.

The operations manual also provides office management information for the facility. This manual should include, but not be limited to following:

- 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.)

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Accurate records should be maintained for all personnel.

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:

- 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

An accurate and feasible budget is critical for ongoing aquatic facility operation. Budget considerations should be included, but not limited to the following:

- 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.

Daily Inspections 6.4.1.3

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.

Daily Inspection
Items

These duties include but are not limited to:

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- 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 xxx. 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 5.7.4;
- Monitor water temperature to ensure it is within range specified in MAHC Section 4.7.4.
- Clean accessible pool surfaces 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

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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.

“The maintenance and repair of Communication Devices and Dispatch Systems shall preserve compliance with the NEC, especially NEC Article 800.”

Entrapment Prevention System info HERE

Emergency Communication System info HERE
--what is included?

REFERENCE FECAL/BLOOD/VOMIT SECTION HERE—
per note from code.

6.4.1.3.7

A sample body fluid contamination response log can be found below.

BODY FLUID CONTAMINATION RESPONSE LOG

Person Carrying out Contamination Response		Supervisor on Duty				
Date (mm/dd/yyyy) of Incident Response		Time of Incident Response	Number of People in Water			
Water Feature or Area Contaminated						
Specify Type/Form of Contamination	Formed Stool Diarrhea Vomit Blood					
Stabilizer Used in Water?	____ YES ____ NO					
Water Quality Measurements	<i>Taken 6 times during DISINFECTION (once every _____ minutes)</i>					
	Closure	1	2	3	4	Prior to Reopening
Time at Measurements						
Free Residual CHLORINE						
PH						
Date (mm/dd/yyyy) that Water Feature was Reopened		Time that Water Feature was Reopened				
Total Contact Time (Time from when disinfectant reached target level to when disinfectant levels were reduced prior to opening)	From _____ To _____ Total Time Lapse _____					
Remediation Procedure(s) Used and Comments/Notes						

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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

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