

Model Aquatic Health Code

Draft Ventilation and Air Quality Module CODE Sections Modified after the First 60-day Review that Closed on 6/12/2011

Informational Copy: NOT Currently Open for Public Comment

This version of the MAHC Ventilation 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 Ventilation and Air Quality Module Abstract

Health issues related to indoor pool use and associated poor water and air quality are increasingly being documented. The Ventilation and Air Quality Module is a first step towards improving air quality at indoor aquatic facilities and reducing associated health effects. The Ventilation and Air Quality Module contains requirements for new or substantially altered construction that include:

- 1) Reliance on ASHRAE 62.1 for determining the amount of outdoor air required.
- 2) Discussion in the Appendix of an alternative way to determine the extra make-up air needed based on the indoor venue water use type (e.g., flat water, agitated water, or hot water) and venue or deck patron density (square feet/person).
- 3) Outlining of air handling system performance criteria
- 4) Outlining of operator maintenance, recordkeeping, and operational requirements.
- 5) Development and implementation of plans to reduce combined chlorine compounds in indoor aquatic facilities and inform facility patrons of their impact on building air quality.

The following chart shows the context of the Ventilation and Air Quality Design, Construction, Operation and Maintenance in the overall Model Aquatic Health Code's Strawman (<http://www.cdc.gov/healthywater/pdf/swimming/pools/mahc/structure-content/mahc-strawman.pdf>).

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4.0 Design Standards and Construction

- 4.1 Plan Submittal
- 4.2 Materials
- 4.3 Equipment Standards
- 4.4 Pool Operation and Facility Maintenance [N/A]
- 4.5 Pool Structure (Shell)
- 4.6 Indoor/Outdoor Environment**
 - 4.6.1 Lighting

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- 4.9 Filter/Equipment Room
- 4.10 Hygiene Facilities (Bathhouse)
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- 4.12 Specific Venues - Special Requirements

5.0 Operation and Maintenance

- 5.1 Plan Submittal [N/A]
- 5.2 Materials [N/A]
- 5.3 Equipment Standards [N/A]
- 5.4 Pool Operation and Facility Maintenance
- 5.5 Pool Structure (Shell)
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6.0 Policies and Management

- 6.1 Operator Training
- 6.2 Lifeguard Training
- 6.3 Facility Staffing
- 6.4 Facility Management
 - 6.4.1 Operations
 - 6.4.2 Patron-Related Management Aspects**

Acronyms and Initialisms in this Module:

ASHRAE	The American Society of Heating, Refrigerating and Air-Conditioning Engineers
DBP	Disinfection by-product
EPA	Environmental Protection Agency
IBC	International Building Code
MAHC	Model Aquatic Health Code
MERV	Minimum efficiency reporting value
NEHA	National Environmental Health Association
RLV	Relative limit value
STEL	Short-term exposure limit
THM	Trihalomethane
TLV	Threshold limit value

Glossary Terms in this Module:

NOTE: All glossary terms are denoted in the text by SMALL CAPS. Also, definitions are still being compiled so this section may not be complete. Thank you for your patience.

“Air Handling System” means equipment that brings in outdoor air into a building and removes air from a building for the purpose of introducing air with fewer contaminants and removing air with contaminants created while bathers are using aquatic venues. The system includes components which move, transport, and condition the air for humidity and temperature control and stratification.

“Aquatic Feature” means an individual component within an aquatic venue. Examples include mushrooms, slides, buckets, spray guns/nozzles, and other play features.

“Aquatic Venue” means an artificially constructed or modified natural structure where the general public is exposed to water intended for recreational or therapeutic purpose. Such structures do not necessarily contain standing water, so water exposure may occur via contact, ingestion, or aerosolization. Examples include swimming pools, wave pool, river, spas (including spa pools and hot tubs), therapeutic pools, spray pads/interactive water venues.

“Code” means a systematic statement of a body of law, especially one given statutory force.

“Contaminant” means a substance that soils, stains, corrupts, or infects another substance by contact or association.

“Disinfection” means a treatment that kills microorganisms (e.g., bacteria, viruses, and parasites); in water treatment, a chemical (commonly chlorine, chloramine, or ozone) or physical process (e.g., ultraviolet radiation) can be used.

“Indoor Aquatic Facility” means a physical place that contains one or more aquatic venues and the surrounding bather and spectator/stadium seating areas within a structure that meets the definition of “Building” per the 2012 International Building Code. It does not include equipment, chemical storage, or bather hygiene rooms or any other rooms with a direct opening to the aquatic facility.

“Pool” means a subset of aquatic venue designed to have impounded/standing water for total or partial bather immersion.

“Purge” means to bring in outdoor air at the same rate required for maximum occupancy until the one complete air exchange of the indoor aquatic facility has been achieved.

“Safety” (as it relates to construction items) means a design standard intended to prevent inadvertent or hazardous operation or use (i.e., a passive engineering strategy).

“Standard” means something established by authority, custom, or general consent as a model or example.

“Substantial Alteration” means the alteration, modification, or renovation of an aquatic venue (for outdoor aquatic facilities) or indoor aquatic facility (for indoor aquatic facilities) where the total cost of the work exceeds 50% of the replacement cost of the aquatic venue (for outdoor aquatic facilities) or indoor aquatic facility (for indoor aquatic facilities).

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 safety and health practices and determine the applicability of regulatory limitations prior to each use.*

Model Aquatic Health Code Ventilation Module 4.0 Design and Construction

Keyword	Section	Code	Grade
	4.0	Design Standards and Construction	
	4.1	Plan Submittal	
	4.2	Materials	
	4.3	Equipment Standards	
	4.4	Pool Operation and Facility Maintenance	
	4.5	Pool Structure	
	4.6	Indoor/Outdoor Environment	
	4.6.1	Lighting	
<i>Ventilation</i>	4.6.2	Indoor Aquatic Facility Ventilation	
<i>Purpose</i>	4.6.2.1	INDOOR AQUATIC FACILITY AIR HANDLING SYSTEMS shall be designed, constructed, and installed to support the health and safety of the building's occupants.	B
<i>Exemptions</i>	4.6.2.2	INDOOR AQUATIC FACILITY AIR HANDLING SYSTEM design requirements do not apply to AQUATIC FACILITIES that do not meet the definition of a "Building" in the International Building Code 2012.	C
<i>Indoor Aquatic Facility</i>	4.6.2.3	AIR HANDLING SYSTEM design requirements shall apply to new or substantially altered INDOOR AQUATIC FACILITIES including the area of the building's AQUATIC VENUES and the surrounding BATHER and spectator/stadium seating areas.	B
<i>Mechanical Code</i>	4.6.2.4	INDOOR AQUATIC FACILITY AIR HANDLING SYSTEM design, construction, and installation shall comply with applicable local CODES.	B
<i>ASHRAE 62.1</i>	4.6.2.5	INDOOR AQUATIC FACILITY AIR HANDLING SYSTEM design, construction, and installation shall comply with ASHRAE standard 62.1 2013, Ventilation for Acceptable Indoor Air Quality, and/or applicable local CODES with additional requirements as stated in section MAHC Section 4.6.2.6	B
<i>System design</i>	4.6.2.6	<i>Air Handling System Design</i>	
<i>Mechanical</i>	4.6.2.6.1	Ventilation shall be provided through mechanical	B

Keyword Systems	Section	Code	Grade
Design Factors and Performance Requirements	4.6.2.6.2	<p>systems and/or engineered openings for natural ventilation.</p> <p>The AIR HANDLING SYSTEM design engineer shall provide plan drawings and documentation showing the design meets the performance requirements per MAHC Section 4.6.2.7:</p> <ol style="list-style-type: none"> 1) Building layout identifying the location of the INDOOR AQUATIC FACILITY, 2) INDOOR AQUATIC FACILITY size including area in square feet and volume in cubic feet, 3) The area in square feet for deck and for stadium seating sections, 4) Maximum BATHER load per AQUATIC VENUE and maximum number of building occupants, 5) Individual AQUATIC VENUE water quality systems, including water recirculation, filtration, DISINFECTION, and secondary treatment systems, 6) Placement of air handling system and other building outdoor air intakes exterior to the building, 7) Placement of air handling system and other building exhaust vents exterior to the building, 8) Placement of return air intakes within the indoor aquatic facility, 9) Placement of supply air locations within the indoor aquatic facility, 10) Identify system capabilities, if utilized, to automatically or manually modulate the amount of outdoor air for the purposes of reducing the number of cfm of outdoor air when occupancy is lower than peak bather/occupant load, and 11) Identify system design to maintain negative air pressure in the INDOOR AQUATIC FACILITY relative to the indoor areas external to it. 	
Other Air Handling Systems	4.6.2.6.3	<p>AIR HANDLING SYSTEM design for chemical storage, mechanical, toilet, shower, and dressing rooms are not included in the scope of this section of the code, but shall be considered for their effects on the performance requirements of MAHC Section 4.6.2.7 such as maintaining negative pressure, temperature</p>	A

Keyword	Section	Code	Grade
		differences, and contribution to the air volume of the INDOOR AQUATIC FACILITY.	
Paddle Fans	4.6.2.6.4	AIR HANDLING SYSTEM design may not consider mechanical fans used to push air within the space as part of the outdoor air calculations for the INDOOR AQUATIC FACILITY as defined in MAHC Section 4.6.2.7.	B
Air Turnover	4.6.2.6.4.1	Mechanical fans used to push air within the space may be used in the calculation for air delivery rate.	
Occupied Open All Seasons	4.6.2.6.5	AIR HANDLING SYSTEM design may include natural ventilation calculated in accordance with the ASHRAE Handbooks to substitute the corresponding portion of mechanical ventilation only if all the calculated exterior openings will be continuously controlled open during all times the INDOOR AQUATIC FACILITY is occupied, regardless of season.	C
Air Distribution Design	4.6.2.6.6	The design of the distribution of supply air and distribution of exhaust or return air shall consider obstacles such as support columns, architectural structures, and AQUATIC FEATURES.	
Performance Requirements	4.6.2.7	Performance Requirements for Air Handling System	
Minimum Outdoor Air Requirements	4.6.2.7.1	The AIR HANDLING SYSTEM shall have a design capability to supply the minimum outdoor air requirements using ASHRAE standard 62.1 2013, Ventilation for Acceptable Indoor Air Quality.	B
System Alarm	4.6.2.7.2	The AIR HANDLING SYSTEM design shall provide system features to notify the operator if the outdoor air entering the indoor AQUATIC FACILITY is below 0.48 cfm/ft ² .	B
Real-Time Occupancy	4.6.2.7.3	Design of the AIR HANDLING SYSTEM shall meet the maximum bather/occupant requirements, however, if a method to determine real-time actual occupancy is available then the system may modulate to reduce outdoor air cfm to meet the requirement for the actual occupancy for the associated time frame.	
Air Deliver Rate	4.6.2.7.4	The AIR HANDLING SYSTEM shall supply an air delivery rate as defined in <u>ASHRAE Handbook – HVAC Applications</u> 2011, Places of Assembly, Natatoriums.	

Keyword	Section	Code	Grade
Consistent Air Flow	4.6.2.7.5	INDOOR AQUATIC FACILITY AIR HANDLING SYSTEM shall be designed to provide consistent air flow through all parts of the INDOOR AQUATIC FACILITY to preclude any stagnant areas.	C
Dew Point / Relative Humidity	4.6.2.7.6	The AIR HANDLING SYSTEM shall maintain the relative humidity in the space as defined in <u>ASHRAE Handbook – HVAC Applications 2011, Places of Assembly, Natatoriums.</u>	B
Maintain Dew Point	4.6.2.7.6.1	The AIR HANDLING SYSTEM shall be designed to maintain the dew point of the interior space less than the dew point of the interior walls at all times so as to prevent damage to structural members and to prevent biological growth on walls.	
Condensation / Mold Control	4.6.2.7.6.2	The AIR HANDLING SYSTEM shall be designed to distribute air toward walls and windows to reduce condensation and mold growth.	B
Negative air pressure	4.6.2.7.7	System air flow shall be designed to maintain negative air pressure in the INDOOR AQUATIC FACILITY relative to the areas external to it.	
Remove disinfection byproducts	4.6.2.7.8	Sufficient return air intakes shall be placed near AQUATIC VENUE surfaces such that they remove the highest concentration of airborne DISINFECTION BY-PRODUCT contaminated air.	
Airflow Across Water Surface	4.6.2.7.8.1	The AIR HANDLING SYSTEM shall be designed considering airflow across the water surface to promote removal of DISINFECTION BY-PRODUCTS	C
Re-entrainment of exhaust	4.6.2.7.9	AIR HANDLING SYSTEM outdoor air intakes shall be placed to minimize RE-ENTRAINMENT of exhaust air from building systems back into the facility.	
System Exhaust	4.6.2.7.9.1	AIR HANDLING SYSTEM exhaust from chemical storage, mechanical, toilet, shower, and dressing rooms shall not be directed into the AQUATIC FACILITY.	
Access Control	4.6.2.7.10	The AIR HANDLING SYSTEM shall be designed to provide a means to limit physical or electronic access to system control to the operator and anyone the operator deems to have access.	B

<i>Keyword</i>	<i>Section</i>	<i>Code</i>	<i>Grade</i>
<i>Purge</i>	4.6.2.7.11	The AIR HANDLING SYSTEM shall have the capability to periodically purge air for air quality maintenance or for emergency situations.	C
<i>Purge Capacity</i>	4.6.2.7.11.1	The AIR HANDLING SYSTEM shall have a purge capacity equal or greater than 2 times the ASHRAE code level. This purge would be activated manually and run for a time that achieved one complete air turn of the space.	
<i>Outdoor Air</i>	4.6.2.7.11.2	Outdoor air required for purge would not be required to be heated or otherwise treated.	
<i>Air handling system Filters</i>	4.6.2.7.12	The AIR HANDLING SYSTEM design shall include filters for outdoor air and recirculated air with a Minimum Efficiency Reporting Value (MERV) rating of 8.	B
<i>Installation</i>	4.6.2.8	<i>Air Handling System Installation</i>	
<i>Air handling System Procedures</i>	4.6.2.8.1	The contractor installing the INDOOR AQUATIC FACILITY AIR HANDLING SYSTEM shall provide the AQUATIC FACILITY owner with an operating manual from the manufacturer which includes: <ol style="list-style-type: none"> 1) Startup and shutdown procedures, 2) Purging and other safety procedures, 3) Cleaning procedures, 4) General maintenance requirements with parts listings and frequency of maintenance (i.e., filter cleaning frequencies, motor bearing maintenance), 5) Pressure differential specifications for filter replacement, filter replacement type, and frequency of cleaning or replacement, 6) Troubleshooting processes, 7) Frequency of required calibration of equipment, 8) Descriptions of general operating schemes, and 9) Contact information for the manufacturer. 	B

4.6.2.9 *Air Handling System Commissioning*

<i>Keyword</i>	<i>Section</i>	<i>Code</i>	<i>Grade</i>
<i>System Commissioning</i>	4.6.2.9.1	A qualified, licensed professional shall commission the AIR HANDLING SYSTEM to verify that the installed system is operating properly in accordance with the system design.	C
<i>Written Statement</i>	4.6.2.9.2	A written statement of commissioning shall be provided to the aquatic facility owner to include but is not limited to: <ol style="list-style-type: none">1) The number of cubic feet per minute of outdoor air flowing into the INDOOR AQUATIC FACILITY at the time of commissioning2) The number of cubic feet per minute of exhaust air flowing through the system at the time of commissioning3) A statement that the amount of outdoor air meets the performance requirements of MAHC Section 4.6.2.7.	

**Model Aquatic Health Code
Ventilation Module
5.0 Operation and Maintenance**

Keyword	Section	Code	Grade
	5.0	Operation and Maintenance	
	5.1	Plan Submittal	
	5.2	Materials	
	5.3	Equipment Standards	
	5.4	Pool Operation and Facility Maintenance	
	5.5	Pool Structure	
	5.6	Indoor/Outdoor Environment	
	5.6.1	Lighting	
	5.6.2	Indoor Aquatic Facility Ventilation	
<i>Purpose</i>	5.6.2.1	AIR HANDLING SYSTEMS shall be maintained and operated by the owner/operator to protect the health and safety of the facility’s occupants.	B
<i>Original Characteristics</i>	5.6.2.2	AIR HANDLING SYSTEMS shall be maintained and operated to comply with all requirements of the original system design, construction and installation.	B
<i>Indoor Facility Areas</i>	5.6.2.3	The ventilation operation and maintenance requirements shall apply to an INDOOR AQUATIC FACILITY including the AQUATIC VENUES, the surrounding BATHER and spectator/stadium seating area, but does not include mechanical rooms, bath and locker rooms, and any associated rooms which have a direct opening to the AQUATIC FACILITY.	C
<i>Ventilation Procedures</i>	5.6.2.4	THE INDOOR AQUATIC FACILITY owner/operator shall develop and implement a program of standard AIR HANDLING SYSTEM operation, maintenance, cleaning, testing, and inspection procedures with detailed instructions, necessary equipment and supplies, and oversight for those carrying out these duties, in accordance with the AIR HANDLING SYSTEM design engineer and/or manufacturer’s recommendations.	
<i>System Operation</i>	5.6.2.4.1	The AIR HANDLING SYSTEM must operate continuously, including providing the required amount of outdoor air;	B
<i>Operation Outside of Operating</i>	5.6.2.4.1.1	The exception is that the amount of outdoor air may be reduced by no more than 50% during non-use periods	

Keyword	Section	Code	Grade
Hours		as long as acceptable air quality is maintained.	
Manuals / Commissioning Reports	5.6.2.5	The QUALIFIED OPERATOR shall maintain a copy of the AIR HANDLING SYSTEM design engineer and/or manufacturer original operating manuals and commissioning reports, updates and specifications for any modifications.	B
Ventilation Monitoring	5.6.2.6	The QUALIFIED OPERATOR shall monitor, log and maintain AIR HANDLING SYSTEM set-points and other operational parameters as specified by the AIR HANDLING SYSTEM design engineer and/or manufacturer.	B
Air Filter Changing	5.6.2.7	The QUALIFIED OPERATOR(S) shall replace or clean, as appropriate, AIR HANDLING SYSTEM air filters in accordance with the AIR HANDLING SYSTEM design engineer and/or manufacturer's recommendations, whichever is most frequent.	B
Combined Chlorine Reduction	5.6.2.8	The QUALIFIED OPERATOR shall develop and implement a plan to minimize combined chlorine compounds in the INDOOR AQUATIC FACILITY from the operation of AQUATIC VENUES.	A
Building Purge Plan	5.6.2.9	The QUALIFIED OPERATOR shall develop an air quality action plan with procedures for purging the INDOOR AQUATIC FACILITY for chemical emergencies or other indicators of poor air quality.	B
Records	5.6.2.10	The owner shall maintain documents at the INDOOR AQUATIC FACILITY to be available for inspection, recording the following: <ol style="list-style-type: none"> 1) A log recording the set points of operational parameters set during the commissioning of the AIR HANDLING SYSTEM and the actual readings taken at least once daily. 2) Maintenance conducted to the system including the dates of filter changes, cleaning, and repairs; 3) Dates and details of modifications to the air handling system; and 4) Dates and details of modifications to the operating scheme. 	C

Model Aquatic Health Code Ventilation Module 6.0 Policies and Management

Keyword	Section	Code	Grade
	6.0	Policies and Management	
	6.1	Operator Training	
	6.2	Lifeguard Training	
	6.3	Facility Staffing	
	6.4	Facility Management	
	6.4.1	Operations	
	6.4.2	Patron-Related Management Aspects	
	6.4.2.1	<i>Bather Load</i>	
	6.4.2.2	<i>Signage</i>	
	6.4.2.3	<i>User Guidelines</i>	
	6.4.2.4	<i>Swimmer Empowerment Methods</i>	
<i>Public Information and Health Messaging</i>	6.4.2.4.1	The owner/operator shall develop and implement a public information and health messaging program to inform INDOOR AQUATIC FACILITY patrons of their impact on INDOOR AQUATIC FACILITY air quality.	C