

2018 Model Aquatic Health Code

Code Language

Mini-MAHC: Preventing In-line Production of Toxic Chlorine Gas Events



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

Extracted from the 2018 MAHC

CS295591-A

Mini-MAHC Code

Preventing In-line Production of Toxic Chlorine Gas Events

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

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

Purpose:

Specific public health issues addressed in the MAHC are often spread across multiple chapters. Mini-MAHCs make the MAHC more accessible by summarizing the code and annex language addressing a specific public health issue into a single, concise document. Environmental health practitioners and pool operators can use Mini-MAHCs to quickly find relevant MAHC guidelines and rationale to promote health and safety of patrons and staff and references content from the 2018 MAHC Code Language (3rd Edition). For MAHC language on general pool chemical safety, go to the Preventing Pool Chemical-Associated Health Events Mini-MAHC.

This Mini-MAHC Code focuses on preventing in-line production of toxic chlorine gas events. Chemical feeders add chlorine to recirculation systems, add then add a pH-adjusting chemical, typically acid further along the recirculation system. This allows chemical dilution to occur so chlorine and acid are safely mixed. If there is no, or low, water flow in the recirculation system (e.g., because the recirculation pump shuts down or pump speeds are reduced) and the chemical feeders continue running, concentrated chlorine and acid mix. Consequently, toxic chlorine gas is generated within the recirculation system. When full water flow is restored to the recirculation system (e.g., the recirculation pump is restarted), toxic chlorine gas enters the aquatic venue and surrounding area. Toxic chlorine gas release and patron exposure usually requires immediate evacuation and can injure scores of patrons and staff. However, they can be prevented by automatic deactivation of chemical feeders in the event of no, or low, flow in the recirculation system.

IMPORTANT

Unless otherwise noted,

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

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

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

1.0 Preface *Note: Section numbers with superscript "A" (e.g., 1.0^A) denote a corresponding discussion in the Annex to the Model Aquatic Health Code.*

3.0 Glossary of Acronyms, Initialisms, Terms, Standards, Codes, and Laws Used in the MAHC Code

3.2 Glossary of Terms Used in the MAHC Code

"Aquatic Facility" means a physical place that contains one or more aquatic venues and support infrastructure.

"Aquatic Venue" means an artificially constructed structure or modified natural structure where the general public is exposed to water intended for recreational or therapeutic purpose and where the primary intended use is not watering livestock, irrigation, water storage, fishing, or habitat for aquatic life. Such structures do not necessarily contain standing water, so water exposure may occur via contact, ingestion, or aerosolization. Examples include swimming pools, wave pools, lazy rivers, surf pools, spas (*including spa pools and hot tubs*), therapy pools, waterslide landing pools, spray pads, and other interactive water venues.

- **"Increased Risk Aquatic Venue"** means an aquatic venue which due to its intrinsic characteristics and intended users has a greater likelihood of affecting the health of the bathers of that venue by being at increased risk for microbial contamination (*e.g., by children less than 5 years old*) or being used by people that may be more susceptible to infection (*e.g., therapy patients with open wounds*). Examples of increased-risk aquatic venues include spray pads, wading pools and other aquatic venues designed for children less than 5 years old as well as therapy pools.

"Automated Controller" means a system of at least one chemical probe, a controller, and auxiliary or integrated component that senses the level of one or more water parameters and provides a signal to other equipment to maintain the parameters within a user-established range.

"Bather" means a person at an aquatic venue who has contact with water either through spray or partial or total immersion. The term bather as defined, also includes staff members, and refers to those users who can be exposed to contaminated water as well as potentially contaminate the water.

"Increased Risk Aquatic Venue" See *"Aquatic Venue."*

"Breakpoint Chlorination" means the conversion of inorganic chloramine compounds to nitrogen gas by reaction with Free Available Chlorine. When chlorine is added to water containing ammonia (*from urine, sweat, or the environment, for example*), it initially reacts with the ammonia to form monochloramine. If more chlorine is added, monochloramine is converted into dichloramine, which decomposes into nitrogen gas, hydrochloric acid and chlorine. The apparent residual chlorine decreases since it is partially reduced to hydrochloric acid. The point at which the drop occurs is referred to as the "breakpoint". The amount of free chlorine that must be added to the water to achieve breakpoint chlorination is approximately 10 times the amount of combined chlorine in the water. As additional chlorine is added, all inorganic combined chlorine compounds disappear, resulting in a decrease in eye irritation potential and "chlorine odors."

"Certified, Listed, and Labeled" means equipment, materials, products, or services included in a list published by an ANSI accredited certification organization where said equipment, material, product, or service is evaluated against specific criteria and whose listing either states that it meets identified standards or has been tested and found suitable for a specified purpose. In sections of this code where equipment, materials, products, or services are referred to with terms such as "approved", "verified" or similar terms to a referenced standard, these terms also mean "certified, listed, and labeled."

"Chemical Storage Space" means a space in an aquatic facility used for the storage of pool chemicals such as acids, salt, or corrosive or oxidizing chemicals.

"Chlorine" means an element that at room temperature and pressure is a heavy greenish yellow gas with a characteristic penetrating and irritating smell; it is extremely toxic. It can be compressed in liquid form and stored in heavy steel tanks. When mixed with water, chlorine gas forms hypochlorous acid (HOCl), the primary chlorine-based disinfecting agent, hypochlorite ion, and hydrochloric acid. HOCl dissociation to hypochlorite ion

is highly pH dependent. Chlorine is a general term used in the MAHC which refers to HOCl and hypochlorite ion in aqueous solution derived from chlorine gas or a variety of chlorine-based disinfecting agents.

“Available Chlorine” means the amount of chlorine in the +1 oxidation state, which is the reactive, oxidized form. In contrast, chloride ion (Cl^-) is in the -1 oxidation state, which is the inert, reduced state. Available Chlorine is subdivided into Free Available Chlorine and Combined Available Chlorine. Pool chemicals containing Available Chlorine are both oxidizers and disinfectants. Elemental chlorine (Cl_2) is defined as containing 100% available chlorine. The concentration of Available Chlorine in water is normally reported as mg/L (*ppm*) “as Cl_2 ”, that is, the concentration is measured on a Cl_2 basis, regardless of the source of the Available Chlorine.

“Free Chlorine Residual” OR **“Free Available Chlorine”** means the portion of the total available chlorine that is not “combined chlorine” and is present as HOCl or hypochlorite ion (OCl^-). The pH of the water determines the relative amounts of HOCl and hypochlorite ion. HOCl is a very effective bactericide and is the active bactericide in pool water. OCl^- is also a bactericide, but acts more slowly than HOCl. Thus, chlorine is a more effective bactericide at low pH than at high pH. A free chlorine residual must be maintained for adequate disinfection.

“Combustion Device” means any appliance or equipment using fire. These include, but may not be limited to, gas or oil furnaces, boilers, pool heaters, domestic water heaters, etc.

“Corrosive Materials” means pool chemicals, fertilizers, cleaning chemicals, oxidizing cleaning materials, salt, de-icing chemicals, other corrosive or oxidizing materials, pesticides, and such other materials which may cause injury to people or damage to the building, air-handling equipment, electrical equipment, safety equipment, or fire-suppression equipment, whether by direct contact or by contact via fumes or vapors, whether in original form or in a foreseeably likely decomposition, pyrolysis, or polymerization form. Refer to labels and SDS forms.

“EPA Registered” means all products regulated and registered under the Federal Insecticide, Fungicide, and Rodenticide Act (*FIFRA*) by the EPA; <https://www.epa.gov/laws-regulations/summary-federal-insecticide-fungicide-and-rodenticide-act>). EPA registered products will have a registration number on the label (*usually it will state “EPA Reg No.” followed by a series of numbers*). This registration number can be verified by using the EPA National Pesticide Information Retrieval System (<http://ppis.ceris.purdue.edu/#>).

“Equipment Room or Area” means a space intended for the operation of pool pumps, filters, heaters, and controllers. This space is not intended for the storage of hazardous pool chemicals.

“Free Chlorine Residual” OR **“Free Available Chlorine”** See “Chlorine.”

“Hyperchlorination” means the intentional and specific raising of chlorine levels for a prolonged period of time to inactivate pathogens following a fecal or vomit release in an aquatic venue as outlined in MAHC 6.5.

“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 (*IBC*). It does not include equipment, chemical storage, or bather hygiene rooms or any other rooms with a direct opening to the aquatic facility. Otherwise known as a natatorium.

“Interior Space” means any substantially enclosed space having a roof and having a wall or walls which might reduce the free flow of outdoor air. Ventilation openings, fans, blowers, windows, doors, etc., shall not be construed as allowing free flow of outdoor air.

“mg/L” means milligrams per liter and is the equivalent metric measure to parts per million (*ppm*).

“Monitor” means the regular and purposeful observation and checking of systems or facilities and recording of data, including system alerts, excursions from acceptable ranges, and other facility issues. Monitoring includes human or electronic means.

“Oxidation” means the process of changing the chemical structure of water contaminants by either increasing the number of oxygen atoms or reducing the number of electrons of the contaminant or other chemical reaction, which allows the contaminant to be more readily removed from the water or made more soluble in the water. It is the “chemical cleaning” of pool water. Oxidation can be achieved by common disinfectants (*e.g., chlorine, bromine*), secondary disinfection/sanitation systems (*e.g. ozone*) and oxidizers (*e.g. potassium monopersulfate*).

“Oxidation Reduction Potential” (ORP) means a measure of the tendency for a solution to either gain or lose electrons; higher (*more positive*) oxidation reduction potential indicates a more oxidative solution.

“**pH**” means the negative log of the concentration of hydrogen ions. When water ionizes, it produces hydrogen ions (H^+) and hydroxide ions (OH^-). If there is an excess of hydrogen ions the water is acidic. If there is an excess of hydroxide ions the water is basic. pH ranges from 0 to 14. Pure water has a pH of 7.0. If pH is higher than 7.0, the water is said to be basic, or alkaline. If the water’s pH is lower than 7.0, the water is acidic. As pH is raised, more HOCl ionization occurs and chlorine disinfectants decrease in effectiveness.

“**Purge**” means to introduce a large volume of outdoor air to flush the interior space.

“**Re-entrainment**” means a situation where the exhaust(s) from a ventilated source such as an indoor aquatic facility is located too close to the air handling system intake(s), which allows the exhausted air to be re-captured by the air handling system so it is transported directly back into the aquatic facility.

“**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*).

“**Safety Plan**” means a written document that has procedures, requirements and/or standards related to safety which the aquatic facility staff shall follow. These plans include training, emergency response, and operations procedures.

“**Safety Team**” means any employee of the aquatic facility with job responsibilities related to the aquatic facility’s emergency action plan.

“**Supplemental Treatment Systems**” means those disinfection processes or systems which are not required on an aquatic venue for health and safety reasons. They may be used to enhance overall system performance and improve water quality.

4.0^A Aquatic Facility Design Standards and Construction

The provisions of MAHC Chapter 4 (*Aquatic Facility Design Standards and Construction*) apply to construction of a new AQUATIC FACILITY or AQUATIC VENUE or SUBSTANTIAL ALTERATION to an existing AQUATIC FACILITY or AQUATIC VENUE, unless otherwise noted.

4.1 Plan Submittal

4.1.2 Content of Design Report

4.1.2.2 Plans and Specifications

4.1.2.2.4 Aquatic Venue Recirculation and Treatment Design Detailed scaled and dimensional drawings for each individual AQUATIC VENUE shall contain a flow diagram showing the location, plan, elevation, and schematics of:

- 1) Filters,
- 2) Pumps,
- 3) **Chemical feeders and interlocks**
- 4) **Chemical controllers and interlocks,**
- 5) SECONDARY DISINFECTION SYSTEMS, if required,
- 6) Supplemental DISINFECTION systems, if installed,
- 7) Ventilation devices or AIR HANDLING SYSTEMS,
- 8) Heaters,
- 9) Surge tanks, including operating levels,
- 10) BACKFLOW prevention assemblies and air gaps,
- 11) Valves,
- 12) Piping,
- 13) Flow meters,
- 14) Gauges,
- 15) Thermometers,
- 16) Test cocks,
- 17) Sight glasses, and
- 18) Drainage system for the disposal of AQUATIC VENUE water and filter wastewater.

4.7 Recirculation and Water Treatment

4.7.3^A Disinfection and pH Control

4.7.3.1 Chemical Addition Methods

4.7.3.1.1 Disinfection and pH DISINFECTION and pH control chemicals shall be automatically introduced through the RECIRCULATION SYSTEM.

4.7.3.1.1.1 Controller Used A chemical controller, as specified in MAHC 4.7.3.2.8 shall be provided and used for MONITORING and control of DISINFECTANT and pH feed equipment.

4.7.3.1.1.2 Feeder DISINFECTION and pH control chemicals shall be added using a feeder that meets the requirements outlined in MAHC 4.7.3.2.

4.7.3.2 Feed Equipment

4.7.3.2.1^A General

4.7.3.2.1.1 Required Chemical feeders shall be required in new or existing AQUATIC FACILITIES upon adoption of this CODE.

4.7.3.2.1.2 Feeders & Devices The AQUATIC FACILITY shall be equipped with chemical feed equipment such as flow-through chemical feeders, electrolytic chemical generators, mechanical chemical feeders, chemical feed pumps, and AUTOMATED CONTROLLERS that are CERTIFIED, LISTED, AND LABELED to NSF-ANSI 50 by an ANSI-accredited certification organization.

4.7.3.2.1.2.1 Specified by Manufacturer Flow-through chemical feeders shall only be used with the chemical (*formulation, brand, size, and shape*) specified by the chemical feeder manufacturer.

4.7.3.2.1.3 Interlock Controls and No or Low Flow Deactivation For all new or SUBSTANTIALLY RENOVATED AQUATIC VENUES and within 1 year of adoption of this CODE for existing facilities, all chemical control and feed systems shall be provided with an automatic means to disable all chemical feeders for each VENUE or portion of a VENUE in the event of a low flow or no flow condition. This shall be accomplished through an electrical interlock consisting of at least two of the following:

- 1) Recirculation pump power MONITOR,
- 2) Flow meter/flow switch in the return line,
- 3) Flow meter/flow switch at the chemical controller.

4.7.3.2.1.3.1 Installed The electrical interlock system shall be installed per manufacturer's instructions and shall never be altered.

4.7.3.2.1.3.2 Visual Alarm For new installations and replacement equipment, if the feeder is disabled through the electrical interlock, a visual alarm or other indication shall be initiated that will alert staff on-site for BATHER evacuation.

4.7.3.2.1.4 Installation The chemical control and feed systems shall be installed according to the manufacturer's instructions.

4.7.3.2.1.4.1 Protective Cover A physical BARRIER shall be installed between chemical feed pumps supplying acid or liquid hypochlorite solution and other POOL components to shield staff and equipment from chemical sprays from leaking connections.

4.7.3.2.3 Introduction of Chemicals

4.7.3.2.3.1 Separation The injection point of DISINFECTION chemicals shall be located before any pH control chemical injection point with sufficient physical separation of the injection points to reduce the likelihood of mixing of these chemicals in the piping during periods of interruption of RECIRCULATION SYSTEM flow.

4.7.3.2.3.2 Backflow Means of injection shall not allow BACKFLOW into the chemical system from the POOL system.

4.7.3.2.6 Salt Electrolytic Chlorine Generators, Brine Electrolytic Chlorine, or Bromine Generators

4.7.3.2.6.7 Interlock The generator(s) shall be interlocked per MAHC 4.7.3.2.1.3.

4.7.3.2.7^A Feeders for pH Adjustment

4.7.3.2.7.1 Provided Feeders for pH adjustment shall be provided on all AQUATIC VENUES upon adoption of this CODE as in MAHC 4.7.3.2.1.2.

4.7.3.2.7.2 Approved Substances Approved substances for pH adjustment shall include but not be limited to muriatic (*hydrochloric*) acid, sodium bisulfate, carbon dioxide, sulfuric acid, sodium bicarbonate, and soda ash.

4.7.3.2.8^A Automated Controllers

4.7.3.2.8.1 **Required** AUTOMATED CONTROLLERS shall be installed for MONITORING and turning on or off chemical feeders used for pH and DISINFECTANTS at all AQUATIC VENUES.

4.7.3.2.8.1.1 **Existing Aquatic Facilities** For existing AQUATIC FACILITIES, AUTOMATED CONTROLLERS shall be required within 1 year from adoption of this CODE.

5.0^A Aquatic Facility Operation and Maintenance

The provisions of Chapter 5 apply to all AQUATIC FACILITIES covered by this CODE regardless of when constructed, unless otherwise noted.

Note: Section numbers with superscript “A” (e.g., 5.0^A) denote a corresponding discussion in the Annex to the Model Aquatic Health Code.

5.6 Indoor / Outdoor Environment

5.6.10 Aquatic Facility Maintenance All appurtenances, features, signage, SAFETY, and other equipment and systems required by this CODE shall be provided and maintained.

5.6.10.4 Aquatic Features

5.6.10.4.3 Flow Rates AQUATIC FEATURE water flow rates shall be checked to be within designer or manufacturer’s specifications prior to opening to the public.

5.7 Recirculation and Water Treatment

5.7.1 Recirculation Systems and Equipment

5.7.1.1^A General

5.7.1.1.1 Continuous Operation All components of the filtration and RECIRCULATION SYSTEMS shall be kept in continuous operation 24 hours per day.

5.7.1.1.1.1 Reduced Flowrates The system flowrate shall not be reduced more than 25% lower than the minimum design requirements and only reduced when the POOL is unoccupied during posted closure hours of the AQUATIC VENUE.

5.7.2 Filtration

5.7.2.2 Granular Media Filters

5.7.2.2.4^A Backwashing Frequency Backwashing of each filter shall be performed at a differential pressure increase over the initial clean filter pressure, as recommended by the filter manufacturer, unless the system can no longer achieve the design flow rate.

5.7.2.2.4.1^A Backwash Scheduling Backwashes shall be scheduled to take place when the AQUATIC VENUE is closed for BATHER use.

5.7.2.2.4.1.1 Backwashing Without Bathers Present BATHERS shall not be permitted to reenter the AQUATIC VENUE until the RESPONSIBLE SUPERVISOR or QUALIFIED OPERATOR ensures that the recirculation pump and chemical feeders have restarted and run for a minimum of 5 minutes following completion of backwashing.

5.7.2.2.4.1.2 Backwashing With Bathers Present A filter may be backwashed while BATHERS are in the AQUATIC VENUE if all of the following criteria are met:

- 1) Multiple filters are used, and
- 2) The filter to be backwashed can be isolated from the remaining RECIRCULATION SYSTEM and filters, and
- 3) The recirculation and filtration system still continues to run as per this CODE, and
- 4) The chemical feed lines inject at a point where chemicals enter the RECIRCULATION SYSTEM after the isolated filter and where they can mix as needed.

5.7.3 Water Treatment Chemicals and Systems Treatment chemicals shall be CERTIFIED, LISTED, AND LABELED to either NSF/ANSI Standard 50 or NSF/ANSI Standard 60 by an ANSI-accredited certification organization, and/or have an EPA FIFRA registration and be used only in accordance with the manufacturer’s

instructions.

5.7.3.1 Primary Disinfectants Only the primary DISINFECTANTS outlined in MAHC 5.7.3 shall be acceptable for use in AQUATIC VENUES.

5.7.3.1.1^A Chlorine (Hypochlorites)

5.7.3.1.1.1 EPA Registered Only CHLORINE products that are EPA-REGISTERED for use as SANITIZERS or DISINFECTANTS in AQUATIC VENUES or SPAS in the United States are permitted.

5.7.3.4^A pH

5.7.3.4.1 pH levels The pH of the water shall be maintained at 7.2 - 7.8.

5.7.3.4.2 Approved Substances Approved substances for pH adjustment shall include but not be limited to muriatic (*hydrochloric*) acid, sodium bisulfate, carbon dioxide, sulfuric acid, sodium bicarbonate, and soda ash.

5.7.3.4.2.1 Certified, Listed, and Labeled Chemicals used for pH adjustment shall be CERTIFIED, LISTED, AND LABELED to either NSF/ANSI Standard 50 or NSF/ANSI Standard 60 by an ANSI-accredited certification organization, and/or have an EPA FIFRA registration.

5.7.3.5^A Feed Equipment

5.7.3.5.1 Acceptable Chemical Delivery Acceptable DISINFECTANT and pH control chemicals shall be delivered through an automatic chemical feed system upon adoption of this CODE.

5.7.3.5.1.1 Dedicated and Labeled Components All chemical feed system components shall be dedicated to a single chemical and clearly labeled to prevent the introduction of incompatible chemicals.

5.7.3.5.1.2^A Installed and Interlocked Chemical feed system components shall be installed and interlocked so the chemical feeder cannot operate when the RECIRCULATION SYSTEM is in low or no flow circumstances as per MAHC 4.7.3.2.1.3.

5.7.3.5.1.2.1 Response to Alarm and Bather Evacuation When the interlock is activated stopping flow from chemical feeders per MAHC 4.7.3.2.1.3 and 5.7.3.5.1.3, or the water recirculation pump is stopped manually or unexpectedly for any reason and duration, including power outages, all BATHERS shall be evacuated from the AQUATIC VENUE until manual evaluation of the cause for interlock activation or recirculation pump interruption is completed by the RESPONSIBLE SUPERVISOR or QUALIFIED OPERATOR.

5.7.3.5.1.2.2 Bather Re-entry BATHERS shall not be permitted to reenter the AQUATIC VENUE until the RESPONSIBLE SUPERVISOR or QUALIFIED OPERATOR has successfully understood the cause of the interlock activation and/or recirculation pump interruption and has manually overridden the interlock for restart of the recirculation pump and chemical feeder, and UV or ozone system, if applicable, for 5 minutes following the restart of these systems.

5.7.3.5.1.3 Fail Proof Safety Features Chemical feed system components shall incorporate failure-proof features so the chemicals cannot feed directly into the AQUATIC VENUE, the VENUE piping system not associated with the RECIRCULATION SYSTEM, source water supply system, or area within proximity of the AQUATIC VENUE DECK under any type of failure, low flow, or interruption of operation of the equipment to prevent BATHER exposure to high concentrations of AQUATIC VENUE treatment chemicals.

5.7.3.5.1.4 **Maintained** All chemical feed equipment shall be maintained in good working condition.

5.7.3.5.1.4.1 **Challenge Testing** The system and its components shall be tested on a regular basis to confirm that all safety features are functioning correctly.

5.7.3.5.1.4.1.1 **Once Monthly or Specified by Manufacturer** Unless specified otherwise by the device manufacturer, once monthly challenge testing of the chemical feeder interlock system shall be conducted by turning off recirculation pump flow to the chemical feeder and ensuring triggered shutoff of chemical feeder occurs via electrical interlock with flow meter/flow switch, paddle wheel, or other device being used to assess flow to chemical feeder.

5.7.3.5.1.4.1.2 **Following Confirmation** Following confirmation of triggered shutoff, recirculation flow shall immediately be restarted.

5.7.3.7 Automated Controllers and Equipment Monitoring

5.7.3.7.1 **Use of Controller** An AUTOMATED CONTROLLER capable of measuring the DISINFECTANT residual (*FAC or bromine*) or surrogate such as ORP shall be used to maintain the DISINFECTANT residual in AQUATIC VENUES as outlined in MAHC 4.7.3.2.8.

5.7.3.7.1.1 **Installed** An AUTOMATED CONTROLLER shall be required within 1 year from time of adoption of this CODE.

5.7.3.7.1.2 **Interlocked** AUTOMATED CONTROLLERS shall be interlocked per MAHC 4.7.3.2.1.3 upon adoption of this CODE if existing or upon installation if not existing.

6.0^A Policies and Management

The provisions of Chapter 6 shall apply to all AQUATIC FACILITIES covered by this CODE regardless of when constructed, unless otherwise noted.

Note: Section numbers with superscript “A” (e.g., 6.0^A) denote a corresponding discussion in the Annex to the Model Aquatic Health Code.

6.0.1 Staff Training All QUALIFIED OPERATORS, RESPONSIBLE SUPERVISORS, maintenance staff, QUALIFIED LIFEGUARD staff, or any others who are involved in the STORAGE, use, or handling of chemicals shall receive training prior to access of chemicals, and receive at least an annual review of procedures thereafter for the following topics discussed in MAHC 6.0.1.1 to 6.0.1.5.

6.0.1.3 Spill Procedures Spill Procedures and Emergency Response outlined in this CODE.

6.0.1.6 Training Plan Employers shall have a training plan in place and implement training for employees on chemicals used at the AQUATIC FACILITY before their first assignment and whenever a new hazard is introduced into the work area.

6.0.1.6.1^A Training Topics The training shall include at a minimum:

- 1) **How to recognize and avoid chemical hazards;**
- 2) **The physical and health hazards of chemicals used at the facility;**
- 3) **How to detect the presence or release of a hazardous chemical;**
- 4) Required PPE necessary to avoid the hazards;
- 5) Use of PPE;
- 6) **Chemical spill response;** and
- 7) How to read and understand the chemical labels or other forms of warning including SDS sheets.

6.1 Qualified Operator Training

6.1.2^A Essential Topics in Qualified Operator Training Courses

6.1.2.1 Course Content All operator training courses recognized by the AHJ shall include, at a minimum, the following teaching elements:

- 1) Water DISINFECTION,
- 2) Water chemistry,
- 3) Mechanical systems, and
- 4) Health and SAFETY operations.

6.1.2.1.4 Health and Safety Course work for health and SAFETY shall include:

- 1) Recreational water illness,
- 2) RWI prevention,
- 3) Risk management,
- 4) Record keeping,
- 5) **Chemical SAFETY,**
- 6) Entrapment prevention,
- 7) Electrical SAFETY,
- 8) Rescue equipment,
- 9) Injury prevention,
- 10) Drowning prevention,
- 11) Barriers,

- 12) Signage and depth markers,
- 13) Facility sanitation,
- 14) **Emergency response**, and
- 15) Surveillance and supervision.

6.1.2.1.4.4 Risk Management Risk management including techniques that identify hazards and risks and that prevent illness and injuries associated with AQUATIC FACILITIES open to the public.

6.1.2.1.4.5 Record Keeping Record keeping including the need to keep accurate and timely records of the following areas:

- 1) Operational conditions (*e.g., water chemistry, water temperature, filter pressure differential, flow meter reading, and water clarity*);
- 2) Maintenance performed (*e.g., backwashing, change of equipment*);
- 3) **Incidents and response** (*e.g., fecal incidents in the water and injuries*); and
- 4) Staff training and attendance.

6.1.2.1.4.6^A Chemical Safety Chemical SAFETY including steps to safely store and handle chemicals including:

- 1) How to read labels and SDS;
- 2) **How to prevent individual chemicals and inorganic and organic CHLORINE products from mixing together or with other substances** (*including water*) or in chemical feeders; and
- 3) Use of PPE.

6.1.2.1.4.15 Emergency Response Plan Emergency response plan including:

- 1) Steps to respond to emergencies (*at a minimum, severe weather events, drowning or injury, contamination of the water, chemical incidents*); and
- 2) Communication and coordination with emergency responders and local health department notification as part of an EAP.

6.3 Facility Staffing

6.3.3^A Safety Plan All AQUATIC FACILITIES shall create and implement a SAFETY PLAN to include, but not be limited to the following elements:

- 1) Staffing Plan,
- 2) EAP,
- 3) Biohazard action plan,
- 4) Pre-Service Training Plan, and
- 5) In-service Training Plan.

6.3.3.1^A Code Compliance Staff Plan Staffing plans shall designate person(s) as members of the SAFETY TEAM and person(s) for the following responsibilities:

- 1) Identifying and communicating health and SAFETY hazards;
- 2) Mitigating health and SAFETY hazards and closing the facility if needed;
- 3) Interfacing with the AHJ related to the requirements of this CODE;
- 4) Maintaining water quality and, if required, air quality;
- 5) Enforcing the AQUATIC FACILITY rules and regulations;
- 6) Responding to reported emergencies;
- 7) Supervising the SAFETY TEAM;
- 8) Conducting pre-service evaluations; and

9) Conducting in-service training.

6.3.3.2^A Emergency Action Plan EAPS and operating procedures shall include but not be limited to:

- 1) Outline types of emergencies and IMMINENT HEALTH HAZARDS, as per MAHC 6.6.3;
- 2) Outline the methods of communication between responders, emergency services, and PATRONS;
- 3) Identify each anticipated responder;
- 4) Outline the tasks of each responder;
- 5) Identify required equipment for each task; and
- 6) Emergency closure requirements.

6.3.3.3 Pre-Service Requirements

6.3.3.3.1^A Safety Team EAP Training Prior to active duty, all members of the SAFETY TEAM shall be trained on, and receive a copy of, and/or have a copy posted and always available of the specific policies and procedures for the following:

- 1) Staffing Plan,
- 2) EAP,
- 3) Emergency closure, and
- 4) Fecal, vomit, or blood contamination on surfaces and in the water as outlined in MAHC 6.5.

6.3.3.3.2^A Safety Team Skills Proficiency Prior to active duty, all members of the SAFETY TEAM shall demonstrate knowledge and skill competency specific to the AQUATIC FACILITY for the following criteria:

- 1) Understand their responsibilities and of others on the AQUATIC FACILITY SAFETY TEAM;
- 2) Ability to execute the EAP;
- 3) Know what conditions require closure of the facility; and
- 4) Know what actions to take in response to a fecal, vomit, or blood contamination on a surface and in the water as outlined in MAHC 6.5.

6.3.4 Staff Management

6.3.4.5 Emergency Response and Communications Plans

6.3.4.5.1^A Emergency Response and Communication Plan AQUATIC FACILITIES shall create and maintain an operating procedure manual containing information on the emergency response and communications plan including an EAP, Facility Evacuation Plan, and Inclement Weather Plan.

6.3.4.5.2 Emergency Action Plan A written EAP shall be developed, maintained, and updated as necessary for the AQUATIC FACILITY.

6.3.4.5.3 Annual Review and Update The EAP shall be reviewed with the AQUATIC FACILITY staff and management annually or more frequently as required when changes occur with the dates of the review recorded in the EAP.

6.3.4.5.4 Available for Inspection The written EAP shall be kept at the AQUATIC FACILITY and available for emergency personnel and/or AHJ upon request.

6.3.4.5.5^A Training Documentation Documentation from employees trained in current EAP shall be available upon request.

6.3.4.5.6 Components The EAP shall include at a minimum:

- 1) A diagram of the AQUATIC FACILITY;

- 2) A list of emergency telephone numbers;
- 3) The location of first aid kit and other rescue equipment (*BVM, AED, if provided, backboard, etc.*);
- 4) An emergency response plan for accidental chemical release; and
- 5) A fecal/vomit/blood CONTAMINATION RESPONSE PLAN as outlined in MAHC 6.5.1.

6.3.4.5.6.1 Accidental Chemical Release Plan The accidental chemical release plan shall include procedures for:

- 1) How to determine when professional HAZMAT response is needed,
- 2) How to obtain it,
- 3) Response and cleanup,
- 4) Provision for training staff in these procedures, and
- 5) A list of equipment and supplies for clean-up.

6.3.4.5.7 Facility Evacuation Plan A written Facility Evacuation Plan shall be developed and maintained for the facility.

6.3.4.5.7.1 Evacuation Plan Components This plan shall include at a minimum:

- 1) Actions to be taken in cases of drowning, serious illness or injury, chemical handling accidents, weather emergencies, and other serious incidents; and
- 2) Defined roles and responsibilities for all staff.

6.3.4.5.8 Communication Plan A communication plan shall exist to facilitate activation of internal emergency response centers and/or community 911/EMS as necessary.

6.3.4.5.8.1 Communication Plan Components At a minimum, this plan shall include:

- 1) Provision and use of readily accessible, appropriate communication devices such as telephones, call boxes, and mobile devices;
- 2) Signage;
- 3) Procedures to be followed during staffed and unstaffed time periods;
- 4) Acceptable alternative communication during loss of power; and
- 5) Training of all personnel.

6.3.4.5.8.2^A Notification Procedures The communication plan shall include a plan for notification to Federal, State, and local agencies in case of a chemical spill that exceeds the EPA reportable quantity.

6.3.4.5.9^A Inclement Weather Plan AQUATIC FACILITIES shall have a contingency/response plan for localized weather events that may affect their operation (*i.e., lightning, hurricanes, tornados, high winds, etc.*).

6.3.4.5.9.1 Contingency Plan Contingency plans shall include training for employees, evacuation procedures, and determining when it is acceptable to re-open a facility for operation.

6.4^A Aquatic Facility Management

6.4.1 Operations

6.4.1.6^A Daily Water Monitoring and Testing Records Daily, or as often as required, MONITORING and testing records shall include, but are not limited to the following:

- 1) pH level,
- 2) DISINFECTANT residuals,
- 3) Combined CHLORINE concentrations,
- 4) Operating pressures of water recirculation pumps and filters or the corresponding flow rate from flow

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- meter readings,
- 5) CYA levels, if used,
 - 6) Maintenance and malfunctioning of equipment, including dates and time of all equipment calibration including WQTDs
 - 7) **Dates of challenge testing of the chemical feeder interlock system as outlined in MAHC 5.7.3.5.1.4.1,**
 - 8) If heated, AQUATIC VENUE water temperature,
 - 9) The time of filter backwash or cleaning,
 - 10) Calcium hardness,
 - 11) Total alkalinity,
 - 12) SATURATION INDEX,
 - 13) Microbiological testing, if applicable, dates/times samples were taken and results,
 - 14) Any equipment failure, power outage, or error resulting in the interruption of the circulation, filtration, or DISINFECTION systems for more than 1 hour,
 - 15) The daily attendance at the AQUATIC FACILITY. In POOLS where attendance is not ordinarily recorded, a guest sign in book can be used to track attendance, and
 - 16) SECONDARY DISINFECTION SYSTEMS as outlined in MAHC 5.7.3.7.7 and 5.7.3.7.8.