POOL SAFETY & OPERATIONS

A Reference Guide for Pool Operators
This reference guide was developed using the “Pool & Spa Safety: A Training Course for Pool and Spa Operators” booklet that Columbus Public Health Environmental Health Division.
www.publichealth.columbus.gov
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SECTION I: INTRODUCTION TO POOL SAFETY

Purpose of Pool Safety

Preventing pool-related illnesses and injuries is a complex issue that requires the help of pool staff, swimmers, and health departments. Poor maintenance can result in low disinfectant levels that can allow the spread of a variety of germs that cause diarrhea as well as skin and respiratory illness. Although pool staff alone cannot completely stop these complex problems, they play a key role in assuring the health of pool visitors. By following pool safety and operations guidelines, pool operators and staff can:

- Protect the public from possible safety and health hazards.
- Gain a basic knowledge of health code regulations.
- Build a good relationship between operators and the health department.

Rules and Regulations

There are many sets of rules which pool operators must know. These rules are important to the health and safety of patrons, and all people in charge at the pool should be aware of the regulations. Below is a list of various agencies who set pool safety standards and enforce these regulations.

- **Livingston County Health Department (LCHD)**, a local public health agency that enforces and regulates aspects such as: water chemistry, physical hazards, safety and required signage. LCHD licenses and inspects all public pools and spas within Livingston County and enforces local and state regulations. See the Livingston County Sanitary Code.
- **Michigan Department of Environmental Great Lakes, and Energy (EGLE)**, a state public health agency, creates regulations for pools and spas that set minimum standards for all public aquatic facilities in Michigan. See the Michigan Department of Environmental Quality Swimming Pool Rules.
- **The Occupational Safety and Health Administration (OSHA)** protects the safety of workers. A key measure used in this protection includes Safety Data Sheets (SDS) which should be available for all substances at your pool. These sheets detail the risk involved with the substance and what should be done to protect yourself from the hazards.
- **The Centers for Disease Control and Prevention (CDC)** does not regulate, but advises and investigates outbreaks of communicable diseases such as Cryptosporidium, Giardia, Shigella and E. Coli.
- **Consumer Product Safety Commission (CPSC)** is charged with protecting the public from unreasonable risks of injury or death from many types of products. This includes swimming pools and ensuring compliance with things such as the Virginia Graham Baker (VGB) Pool & Spa Safety Act.
- **U.S. Department of Justice** oversees and enforces the Americans with Disabilities Act (ADA) which ensures equal opportunities to people with disabilities.
Public Health Concerns

Pools can spread germs that have become contaminated by fecal matter. Chlorine is good at killing these germs, but it takes time and some germs like "Crypto" can live for days.

Common forms of diseases that are spread in pool water include: E. Coli 0157:H7; Hepatitis A; Giardia; and Cryptosporidium (Crypto).

A diarrheal fecal incident is a higher-risk event than a formed-stool incident. With most diarrheal illnesses, the number of germs found in each bowel movement decreases as the diarrhea stops and the person’s bowel movements return to normal. So a formed stool is less of a risk than a diarrheal incident that you may not see. A formed stool may contain no germs, a few, or many that can cause illness. You won’t know. Most germs found in formed stool are contained within the stool. Prompt removal of the formed stool before the germs can be exposed in the water is important.

If a pool is not properly maintained they can present a greater risk for disease transmission. It’s important that pool operators are routinely checking the water chemistry at least three times a day to ensure ideal disinfectant and pH levels are present. Trained pool operators are critical to preventing disease transmission in swimming pools.

The table above shows the contact time for killing most water related germs. Depending on the fecal incident, your should follow the CDC’s "Fecal Incident Response Recommendations for Aquatic Staff".

Pool Operator Requirements

- Pool owner must provide an authorized representative that holds current training in pool operations and maintenance.
- The pool operator must be proficient in swimming pool operation and authorized by the owner to operate the pool mechanical equipment, close the pool when necessary, test pool water and adjust the pool water chemistry.
- The pool operator must be either on site or within 15 minutes of the facility during any time(s) the pool is open for use.
- Training should be provided on a routine basis. LCHD provides FREE annual training for pool operators in late April/early May. It's recommended that all pools participate. It is a great opportunity to ask questions and learn from others. Program updates are provided to support a safe and healthy swim season.
SECTION II: PUMP ROOM OPERATIONS

Pool Capacity and Draining Requirements

It is important to know the water capacity of your pool or spa. Pool (or spa) capacity is measured in gallons and can be determined when you know the measurements of your pool (or spa). See the appendix in the back of this workbook for a Calculation and Conversion worksheet to assist you in determining your pool’s capacity.*

Draining spas and pools entirely is necessary when water balance concentrations are off and no other solution is successful.

For public spas, you must drain completely at least once every 30 days.

*You may also call LCHD for inquiries related to your pools design.

Pump Room Flow Diagram

This is a schematic of a pool equipment room.
Hair and Lint Traps

You must have a hair and lint trap connected to your pool or spa’s circulation system. This trap comes before the main filter and cleans out large debris such as hair and lint. If you are using a vacuum diatomaceous earth (DE) filter, you may not need a hair and lint trap as the DE filter itself acts as the trap.
Filters - *Follow manufacturer’s instructions.*

Filters are a basic component of a pool filtration systems. Their main function is to filter debris from the pool. They come in several common forms.

- **Sand filters**, commonly used in public pools and spas, are large drums containing a fine sand media. Water is pushed through the sand and particles are filtered out.

- **Diatomaceous earth (DE) filters** are able to remove the smallest particles of all pool filters. These filters can be pressure or vacuum systems. They use diatomaceous earth (DE) powder that attaches to filter grids or fingers.

- **Cartridge filters** are often pleated which maximizes the surface area. These filters are usually replaced every six months.

Disinfection Systems

Disinfection systems are a critical part of pool maintenance. Disinfectants kill illness causing germs and help keep swimmers safe.

**PRIMARY SYSTEMS:**

- **Erosion Feeders**: Erosion feeders work with chemicals in solid forms such as chlorine or bromine tablets. The tablet (or stick, briquette, etc.) is placed in the feeder, and as water is forced past the chemical, it dissolves and is distributed into the circulation system and body of water.

- **Liquid Solution Feeders**: Liquid disinfectants such as liquid chlorine are fed into the water downstream of the filters and heating systems in a circulation system. You must ensure there is enough pressure in the system to get enough disinfectant into the circulation system.

- **Salt Chlorine Generators**: This disinfectant method utilizes salt that is added to the swimming pool. The salt solution passes through an electrolytic cell which produces chlorine from the chloride ion in salt.

**SECONDARY SYSTEMS (USED IN ADDITION TO PRIMARY SYSTEM):**

- **Ozone Generators**: Ozone gas is an effective water disinfectant. However, because it can be hazardous to humans, there is a limit to people’s exposure to ozone. The placement, installation and care of this equipment is important. Ozone is injected into the water, and all ozone should be used before the ozonated water enters the pool or spa. You must use chlorine or bromine in addition to ozone when disinfecting in this manner.

- **Ultraviolet (UV) Systems**: Water can be disinfected using ultraviolet lamps to generate UV radiation. Water in the circulation system flows through a UV cell to inactivate bacteria and viruses. The UV light will also oxidize chloramines. Additionally, you also must use chlorine or bromine when using this uncommon method of disinfecting.
Disinfection Control and Automatic Controllers

As discussed before, the disinfection system is a very important part of any pool or spa operation. In order to ensure proper dosage, your pool or spa must have a chemical feeding device connected directly (interlocked) to the circulation system. Hand dosing to continuously disinfect the pool or spa is not acceptable.

An automatic disinfection controller must be in use to monitor and adjust the level of disinfectant (free chlorine or bromine) in order to maintain the minimum required level of disinfectant in the spa. This must be the primary means of disinfectant level control.

The automatic controller in the aquatic facility must also measure the pH and be able to regulate the pH level by adding the appropriate chemicals if adjustments are needed.
Sodium hypochlorite, often called “liquid chlorine” because of its liquid form, is one of the most commonly used disinfectants at pools and spas. The acceptable “available chlorine content” strength for liquid chlorine used in pools and spas is 10-12% with a pH level of 13 (high pH, alkaline). In order to balance the high pH, you can add an acid, such as muriatic acid, or inject CO₂. Both techniques can lower the pH to an approved level between 7.2-8.0.

This disinfectant is the dry form of chlorine. Calcium hypochlorite, sometimes known as “cal-hypo,” comes in tablet, briquette, or granular form. Cal-hypo tends to raise the pH of water from an ideal pH of 7.5 to a high pH of between 8.5 and 11. Adding muriatic acid to pools through the circulation system will lower the pH if necessary. Using cal-hypo may result in high calcium levels. This can be good if you have very soft water, but an excess of calcium can cause scaling on pool or spa surfaces.

**Type of Disinfectant:** Sodium Hypochlorite (Liquid Chlorine)

**Type of Disinfectant:** Calcium Hypochlorite (Cal-Hypo)

**Type of Disinfectant:** Tri-Chlor and Di-Chlor

**TRI-CHLOR:** Tri-chlor typically comes in a dry tablet or stick form and is put into the water by an erosion feeder. Tri-chlor must be carefully handled, as it is a Class I oxidizer, and it may speed combustion and ignite. The pH of a pool or spa will lower due to tri-chlor’s low pH of 2.8-3.5 (acidic). You can use sodium carbonate or sodium sesquicarbonate to increase the pH. Tri-chlor also produces cyanuric acid which stabilizes chlorine but can cause reduced effectiveness at excess levels and lead to cloudiness in your pool. You must be sure to test your pool regularly to maintain proper water balance.

**DI-CHLOR:** This chemical, a dry tablet which is very soluble in water, has a nearly neutral pH of 6.7. Di-chlor, like tri-chlor, is a hazardous oxidizing chemical and should be handled with great care. Di-chlor also has the same cyanuric acid build-up concerns that tri-chlor has. This disinfectant can be used in spas when pH control is of concern and is often used to superchlorinate vinyl-lined pools.
Bromine, a temperature stable product, works like chlorine to disinfect pools. Typically, a solid form of hypobromous acid which contains bromine, hydrogen, and oxygen is dissolved to sanitize the water. When bromine reacts with nitrogen, the products (bromamines) have less odor and do not irritate patrons as much as chloramines. Bromine becomes ineffective when exposed to sunlight and works best in indoor pools and spas. Half of the bromine in an outdoor pool can be destroyed in 60-90 minutes of sunlight.

Type of Disinfectant:
Salt Generated Chlorine

This disinfectant method utilizes salt that is added to the swimming pool. The salt solution passes through the electrolyte cell which produces chlorine from the chloride ion in salt. The salt level appropriate to maintain a proper chlorine level is about 3000 to 3500 ppm. This amount of salt is typically undetectable by bathers. If the salt concentration exceeds 6000 ppm, corrosion damage to metallic equipment can occur. Cells also need to be routinely cleaned to ensure they are working properly.
Turnover Rates, Flow Rates & Flow Rate Indicators

The turnover rate of a pool or spa is the amount of time it takes for the total water volume to go through the filtration system. This rate is dependent on the circulation system you are using.

For public swimming pools, the minimum turnover rate is once every 6 hours.
For wading pools, the minimum turnover rate is once every 1 hour.
For public spas, the minimum turnover rate is once every 1 hour.

**To determine the pool or spa’s minimum flow rate see this EXAMPLE:**

1. Calculate pool capacity (see Appendix I):  = 22,500 gallons
2. Determine the minimum turnover rate: Public swimming pool = 360 min
   
   \[(6 \text{ hrs. x 60 min/hr.} = 360 \text{ min})\]
3. Calculate flow rate in gallons per minute: Flow rate = Pool capacity/Turnover rate

**EXAMPLE Solution:** Flow Rate = 22,500 gallons / 360 minutes = 62 gallons per minute

The flow rate is the rate of water flow through the circulation system, and is measured in gallons per minute (GPM). Flow rate = pool capacity/turnover rate.

Your flow meter (example shown below) should read at or above your calculated minimum required flow rate.

The flow meter must be strategically set up in your equipment room so it can accurately read the flow rate. You must have a straight length of piping before and after your flow rate indicator. Check your indicator's instructions on exact lengths. (See the picture below for a visual representation of this set-up).

Ensure that your flow meter is working properly. The float tends to get stuck and give inaccurate results. This problem can be remedied by cleaning the flow meter. When draining the pool or when the circulation pump is off, we recommend you check the indicator to make sure that the float drops to zero.

A pump curve is also an acceptable method of determining the rate of flow and uses the vacuum reading and pressure reading to determine the total dynamic head. The total dynamic head is used to determine the rate of flow on the pump curve chart. Pump curves are specific to each type of pump.
The equipment in your aquatic facility helps keep your pool or spa safe for patrons. You must make sure that all aspects of your pool are in proper working condition so your facility is operating at its best.

It can be easy to neglect the equipment room because it is hidden from the view of the public. But, it is very important to ensure that this room is:

- Clean and well-drained;
- Adequately lit and ventilated; and
- Not accessible to bathers and patrons.

Pool chemicals can be hazardous if used improperly. Pool chemicals should be properly stored and labeled. All employees with access to the chemical storage area must have a knowledge of the chemicals as well as the dangers of improper use. See the manufacturer’s instructions for safety precautions.

**Moisture:** Chemicals must be stored in a dry area. Containers should always be closed properly and not stored near leaks. Storing chemicals off the floor will help keep them dry.

**Improper Mixing:** Many pool chemicals are incompatible with each other and could be hazardous if mixed. Do not mix chemicals, even if they are the same type. Muriatic acid and liquid chlorine are examples of incompatible chemicals that should be stored separately.

**Protection:** To protect employees, a facility should provide personal protective equipment when necessary. All chemicals must be properly labeled. You must provide safety data sheets (SDS) on-site to help employees become aware of the hazards and preventative measures related to pool chemicals.
SECTION III: POOL OPERATIONS

Chlorine Chemistry

Disinfectants such as chlorine undergo complicated chemical processes in water to help make them suitable for recreation. In order to understand how it works, we need to look at a couple of chlorine’s states in water and what effect that has on the water.

**Free Chlorine = Available disinfectant**

**Combined Chlorine (aka Chloramines) =** Result of free chlorine reacting with organic compounds containing nitrogen (N). Sources of organic compounds containing nitrogen are urine, sweat and the environment.

**Total Chlorine - Free Chlorine = Combined Chlorine**  *(Use a test kit to determine total and free chlorine.)*

Free chlorine is required to be at a level of at least 1-2 ppm. Free chlorine residual shall not exceed 10 ppm or the facility’s test kit, whichever is lower. Too much can cause irritation and too little will not eliminate harmful bacteria and germs. Combined chlorine is ideally ZERO. Too much can create the “chlorine” smell in indoor facilities.

Superchlorination - Shocking

Superchlorination, often called “shocking,” is a method of adding a larger dose of chlorine. This dose should be 10 times the amount of combined chlorine, subtracting the existing free chlorine, to achieve breakpoint chlorination. This results in the elimination of combined chlorine and increases the free chlorine level. Free chlorine is 25 times more effective than combined chlorine, therefore, superchlorination causes a decrease in bacteria and algae growth.

**Combined Chlorine x 10 - Exiting Free Chlorine = Break Point**

During swimming season, superchlorinate as needed when the combined chlorine level exceeds 0.4 ppm. At all times, combined chlorine levels should remain below 1.0 ppm. Because free chlorine levels above 5 ppm can cause irritation to swimmers, swimming should be limited until the free chlorine level drops below 5 ppm. It is best to superchlorinate after hours to allow the disinfectant to properly circulate. If there is a fecal-related accident at your pool, close and shock the pool.
Other Water Balance Factors

In order to have effective disinfection, you must make sure that your water is “balanced.” This means all chemical parameters need to be kept within the required limits. Some aspects of water chemistry will directly affect others. For example, a disinfectant such as tri-chlor can lower the pH below the required range due to its acidic pH.

Three chemical parameters that are key in balancing your water, (pH, total alkalinity, and calcium) are below. This chart provides examples of what can go wrong in a pool or spa if the levels are too low or too high. Two other factors — temperature and total dissolved solids — are discussed in the next section.

<table>
<thead>
<tr>
<th>pH</th>
<th>Total Alkalinity</th>
<th>Calcium Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>What is it?</strong></td>
<td>Measurement of hydrogen ions in the water. Human tears have a pH of about 7.5, and the ideal range in your water is 7.4-7.6</td>
<td>Ability of the water to resist changes in pH; a “buffer” for pH changes in the water.</td>
</tr>
<tr>
<td><strong>Too high?</strong></td>
<td>Scaling water (clogged filters and heating elements, reduced circulation, cloudy water), chlorine inefficiency, eye/skin irritation</td>
<td>pH lock, cloudy water, rough pool/spa surfaces, clogged filters and heater elements, reduced circulation</td>
</tr>
<tr>
<td><strong>Too low?</strong></td>
<td>Corrosive water (etching of pool/spa surface, metal corrosion), chlorine loss, wrinkles in vinyl liners, eye/skin irritation</td>
<td>pH bounce, etching of pool/spa surfaces, staining of surface walls, heater failure</td>
</tr>
</tbody>
</table>

Temperature

Unlike pH level and disinfectant concentration, temperature is a physical factor that contributes to water quality. In pools, the water temperature should not be more than 86°F unless otherwise approved. In spas, the temperature should not be above 104°F.

At high temperatures, the disinfectant can quickly evaporate. If temperatures are extremely high, scalding also can occur.
**Cyanuric Acid (AKA Stabilizer or Conditioner)**

**What is cyanuric acid?** Cyanuric acid is a chemical that can lessen the effect of free chlorine breakdown in a pool by sunlight. Some solid forms of chlorine contain cyanuric acid or it can be added as a supplement. Tri-chlor and di-chlor are two solid forms (tablet, briquette, powder, etc.) of chlorine that are commonly used. Cyanuric Acid should only be used in outdoor pools that are using chlorine as the primary disinfectant. Check your disinfectant labels to know if you are using one of these forms of chlorine. By weight, di-chlor contains 57% cyanuric acid and tri-chlor contains 54% cyanuric acid.

**Factors to consider when using cyanuric acid:** Cyanuric acid is most effective between 30-50ppm. State law requires that cyanuric acid not exceed 70ppm. When the cyanuric acid level is above 70ppm, chlorine is less effective as both a disinfectant and algaeicide. Cyanuric acid does not break down or evaporate; as more is added the amount in the pool increases. Increased cyanuric acid levels decrease the ability of chlorine to affectively kill germs. The best way to reduce cyanuric acid is to partially drain the pool and add fresh water. Cyanuric acid should not be used in indoor facilities.

**Water Chemistry Parameters**

Regulations are in place to ensure all aspects of the water chemistry are at levels that will protect the health and safety of swimmers. Below is a listing of “required” levels and “ideal” levels which are most desired.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Required Levels</th>
<th>Ideal Levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Chlorine*</td>
<td>At least 1 ppm</td>
<td>Pools w/ CYA: 2-4 ppm</td>
</tr>
<tr>
<td></td>
<td>At least 2 ppm</td>
<td>Spas w/ CYA: 3-5 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Combined Chlorine</td>
<td>Less than 1 ppm</td>
<td>0 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bromine</td>
<td>At least 2 ppm</td>
<td>Pools: 3-5 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spas: 4-6 ppm</td>
</tr>
<tr>
<td>pH Values</td>
<td>7.2-8.0</td>
<td>7.4-7.6</td>
</tr>
<tr>
<td>Total Alkalinity</td>
<td>At least 60 ppm</td>
<td>80-120 ppm</td>
</tr>
<tr>
<td>Cyanuric Acid</td>
<td>Less than 80 ppm</td>
<td>20-40 ppm</td>
</tr>
<tr>
<td>Calcium Hardness</td>
<td>N/A</td>
<td>Pools: 200-400 ppm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Spas: 150-250 ppm</td>
</tr>
<tr>
<td>Temperature</td>
<td>Pools: Not above 86°F</td>
<td>Pools: Not above 90°F</td>
</tr>
<tr>
<td></td>
<td>Spas: Not above 104°F</td>
<td>Spas: Not above 104°F</td>
</tr>
</tbody>
</table>

*Free chlorine residual should not exceed 10 ppm or the facilities test kit threshold, whichever is lower. If any of these levels are too low or high in your pool or spa, changes should be made. See the Water Balance Adjustment chart in the back of this workbook for help attaining proper levels.*
Testing The Water

It is mandatory that each licensed pool or spa have a *diethyl-p-phenylenediamine* (DPD) test kit.

- Read directions. Not all test kits are the same. Before using your test kit, read all directions.
- Store in a cool, dark place. The testing chemicals in some kits have an adverse reaction to high or low temperatures and light. Keeping the kit closed and in a cool area will help the chemicals remain accurate.
- Keep equipment clean. Debris, dust or foreign chemicals may cause the testing equipment to give a false reading. Keep the kit closed when not in use.
- Do not mix test kits. Some kits use different reagents or different strengths of reagents. You should only use the reagents made for your kit and follow the testing directions for that kit.
- Replace reagents yearly. The reagents used in testing can go bad, so replacing them yearly and properly caring for them will ensure they work accurately. Read the directions for your kit to see if you need to replace the reagents more often. Check for expiration dates.

You must be able to measure these factors:

- Chlorine (or bromine)
- pH
- Total alkalinity
- Cyanuric acid
- Water temperature
- Clarity

When testing your pool or spa, *remember these helpful tips*:

- Test water chemistry upon opening and at least once every 4 hours.
- Do not take water samples near inlets and outlets.
- Make sure all chemical treatments have completely dissolved and mixed.
- Test logs must be kept on file and submitted to LCHD monthly.
- Use a certified lab for bacteria testing of water samples.
- Submit weekly bacteria samples to LCHD.
- Calibrate your thermometer regularly to ensure accurate readings. *(see the Appendix IV.)*

*If water is not tested and properly balanced, the chance for growth of a waterborne illness in the water increases. See the appendix of this workbook for more information on waterborne illnesses that are common in pools and spas.*
SECTION IV: RECORD KEEPING

Fees

Each year pool owners are required to submit license renewal fees. One fee is paid directly to EGLE for your license and other is paid to LCHD for the inspection and other technical support. LCHD sends out invoices to all pools in January. All fees must be paid in full before the annual inspection.

Record Keeping

Keeping accurate records is an important responsibility at any pool or spa. Documentation requires time and effort, but will be a benefit to your facility.

Document the following items on a daily basis:

- All injuries and fecal incidents as they happen
- Total Alkalinity
- Temperature

Document the following items upon opening and every 4 hours:

- Free chlorine
- Combined Chlorine
- All chemicals added
- Total Chlorine/Bromine
- pH
- Water clarity

Document the following item every week:

- Stabilizer (Cyanuric Acid, CYA), if used

Submit weekly bacteria water samples to LCHD.

You must submit a copy of your monthly operator report to Livingston County Health Department within 10 days after the end of the month which the pool was in operation. Report template can be found at https://www.livgov.com/health/eh/Pages/pools.aspx
Fecal Incidents

If a fecal accident occurs, immediate action must be taken and the pool or spa closed. The pool or spa must remain closed until it has been properly treated in accordance with procedures outlined in the CDC’s “Fecal Incident Response Recommendations for Aquatic Staff”. An example action that may be taken is:

- Close the pool. Call LCHD.
- Collect as much as possible in a bucket or net and dispose in a sanitary manner.
- It is **not recommended to vacuum**.
- Keep the pool closed until the following conditions are met. *Disinfection* times will be longer when using chlorine stabilizer (CYA). Check CDC guidance for proper parameters.
  - Formed Stool – Raise the water’s free chlorine concentration to 2 ppm. Maintain free chlorine concentration at 2 ppm and water at pH 7.5 or less for 25-30 minutes. For other concentrations or closure times, see CDC guidance.
  - Diarrhea – The pool or spa needs to be superchlorinated/shocked to raise the free chlorine to at least 20.0ppm and kept closed at least 12.75 hrs.
- Document and record the incident.
- Collect bacteria water sample prior to opening and contact LCHD for approval to re-open.

Injuries

Serious injuries are those that require medical treatment other than first aid.

The following items should be reported to the licensor:

- Incidents that result in death or serious injury
- Assistance from emergency medical personnel
- Illness involving more than one person

*Reporting forms for the fecal or injuries can be found at [https://www.livgov.com/health/eh/Pages/pools.aspx](https://www.livgov.com/health/eh/Pages/pools.aspx)
SECTION V: FACILITY SAFETY

Main Drains & Safety Vacuum Release System (SVRS)

Main drains are important to your pool’s operations. Things to remember about main drains:

- Main drains must be in the deepest area of a pool or spa.
- They must be covered by outlet covers which are VGB compliant, require the use of tools for removal, and are maintained in good condition.
- Main drains must be visible.
- Ensure that the suction outlet covers have not exceeded their manufactured lifespan.
- A certificate of compliance for each outlet cover must be kept on file with the date of installation.

When a main drain can become blocked by something covering its opening, it creates a tight suction or vacuum between the drain and the blockage. This can cause dangerous entrapment of pool or spa patrons unless there is more than one main drain or a vacuum limit switch in place.

Safety Vacuum Release Systems (SVRS) are required on pools or spas with one main drain on direct suction. This device senses a blockage on the drain and reduces or eliminates suction at the drain. It should be mounted ahead of the hair and lint strainer in your equipment room or integrated with your pump.

Skimmers

Skimmers are located in the pool wall near the surface of the water and contain a basket which filters out objects and keeps them from getting into the circulation system.

Skimmer weirs are buoyant levers located before the basket that act as a one-way gate, allowing water from the pool in, but not allowing water and debris already in the circulation system out.

Equalizer Lines and Vacuum Lines are usually located below the skimmer box and allow suction to protect equipment if there is a blockage in the skimmer box or low water level. These lines also must have a VGB compliant cover, be plugged in the pool wall by non-hazardous means or be removed.
Safety Equipment

Spine Board: All pools must have at least one spine board with ties, runners, and a head immobilizer. If there are pools that share a common fence surrounding them both, these pools may share one spine board.

Rescue Pole: This pole, as shown, must be one piece and at least 12 feet long with blunt ends and which may have a shepherd’s crook.

Personal Flotation Device: For pools without lifeguards, you must have a “U.S. Coast Guard approved type IV personal flotation device” that has a line or rope attached that is at least 1/4 of an inch in diameter and 1 1/2 times the maximum width of the swimming pool or 50 feet, whichever is less with 1 end attached to a 18 inch diameter ring buoy or rescue bag.

First Aid Kit: There must be a first aid kit in a location that is easy to access at each pool. If the kit is not readily visible at the pool, a sign must be posted giving the location of the kit. The kit cannot be located in a locked room. This kit must contain new disposable gloves and materials such as bandages to stop bleeding and clean minor cuts and scrapes. This kit is an important part of your pool’s safety system. Check the first aid kit regularly, and if materials are expired or out of stock, replace them with new products.

Emergency Phone

Because emergencies may occur, patrons need quick and easy access to a phone to contact emergency responders. You must make sure that whenever the pool or spa is open, patrons and lifeguards have access to the emergency phone and that it is in proper working condition. If the emergency phone is not located within the pool enclosure, a sign indicating where the phone can be found must be posted.

Posted next to the phone should be a list of emergency numbers, such as police, fire and rescue units in your area and the address of the facility where the public swimming pool is located.
Lifeguards

Lifeguards can be a very important part of your aquatic facility. In emergency events, a person’s life could be saved if there is a trained and certified lifeguard to respond on-site. Lifeguards can also prevent hazardous situations from occurring by maintaining a safe aquatic area at all times.

Who must have lifeguards?

*MI Public Swimming Pool Rules* states...

- All pools except wading or spa which are owned or operated by a government, governmental subdivision or agency, a public corporation or a school.
- All pools with diving boards.
- All pools with surface areas of 2,400 square feet or greater
- All pools with a surface area of less than 2,000 square feet and more than 50 people occupying the pool

How many lifeguards are needed?

- See *MI Public Swimming Pool Rules Rule 98(2)* for more information on lifeguards.

Lifeguards must...

- Be capable swimmers
- Have a valid and current lifeguard certification
- Be certified in CPR in infant, child, and adult
  - The pool operator must have copies of lifeguard certifications on file.
- Be prepared to enter the water at any time
- Have a rescue tube and a CPR pocket mask on their person
- Be similarly attired and readily identifiable
SECTION VI: DESIGN REQUIREMENTS

Fencing

Fencing (or barriers) around any body of water is important to keep both pool patrons and the general public outside of the aquatic facility safe from unnecessary dangers. All swimming pools must follow these mandatory regulations on physical barriers:

- All fences must be at least 4 feet high measured from the ground.
- All perimeter fences or barriers shall not have any footing for climbing and must be designed to prevent passage through or under enclosure.
- All doors or gates shall be self-closing, self-latching and lockable.
- All barriers should require a key for entry and must be locked whenever the pool is closed.
- If a perimeter barrier is not in compliance, the facility must provide staff that must remain physically present to prevent unauthorized access or the pool must be closed.
- Access to areas (fire pit, grill, etc.) enclosed by the perimeter barrier shall be authorized only when the pool is open.

Handrails, Ladders, and Steps

- All public swimming pools shall have safe entry/exit through use of ladders, recessed steps, stairs with handrails, or zero depth entry.
- Ladders shall be corrosive-resistant, sturdy, have slip resistance treads, side rails extending over the deck, and not be more than 6 inches from the swimming pool wall.
- Front edge of all steps must be marked in a contrasting color with pool background.
- All ramps must be slip resistant and have a sturdy handrail.
Safety Line

Safety lines or float lines are floating buoys strung along a rope and stretched across the width of a pool at depth changes or depths of more than 5 feet. These lines keep patrons aware of the increasing depth of a pool. Public pools and spas must follow these regulations on safety lines:

- Lines must be anchored to the interior pool wall.
- The line needs to be 1 foot toward the shallow side of the slope change.
- Lines may be temporarily removed for lap swimming or other aquatic activities.
- Lines should be used to visually designate slide splash down areas when open and accessible to bathers.
- Safety lines must be installed in pools:
  - When the depth is greater than 5 feet.
  - Where the bottom slope changes.

Decks

The deck surrounding a pool is an important aspect of any aquatic facility and should always be maintained and in compliance with regulations. Pool and spa decks should comply with the following:

- Should provide at least 4 feet of unobstructed walkway around pool unless otherwise indicated by LCHD.
- No standing water on decks.
- Sealed joints between pool coping and walkway.
- Ensure any covers (i.e. skimmers) or other joints are flush with the deck or walkway surface.
Pool water must come from an approved source. Because pool water typically comes from the same lines that deliver drinking water, an approved method of backflow prevention must be in place. Your pool or spa must have one of the following:

- An acceptable air gap not less than 2 diameters of the water supply pipe and the overflow level of the receiving pipe, tank, or vessel.
- An approved reduced pressure zone backflow preventer which is installed where it is readily accessible for inspection and maintenance, which is not subject to flooding, and which does not have a direct connection between the drain port and a wastewater system.

Some examples may include:

- ASSE 1013 in use for direct connections (mechanical device)
- ASSE 1011 for a fill line connected to a hose bib
- ASSE 1019 spigot for a fill line
SECTION VII: SIGNAGE

Deck Signage

Depth Markings and “No Diving” Signs

Depth markers and no diving signage must be present on deck.

- Letters for both signs must be at least 4 inches high and in contrast to the deck background.
- An equivalent “No Diving” graphic can be used in place of the words “No Diving”.
- Both signs must be within 2 feet of the water’s edge or 6 inches of the gutter.
- Depth markings and “No Diving” signs should be next to one another.
- There must be at least two depth markings per spa or wading pool.
- Depth markings and “No Diving” signage cannot be more than 25 feet apart at all pools.
- Deck signage must be slip resistant
- “No Diving” signs are not required for wading pools or public spas.
- “No Diving” signs are not needed in pool areas with depths of more than 5 feet.

Safety Signage

In addition to the “No Diving” signs and the depth markings on the pool deck, other signs must be in the area to help ensure the safety of patrons.

If your pool is not required by law to have a lifeguard, you must post a sign stating all the following:

- Warning/Danger-No Lifeguard
- Swimming alone is not recommended.
- Children must be supervised.

Close to each pool or spa, you must post a sign stating the location of the nearest telephone if the phone cannot be seen from the pool or spa area.

At the emergency phone, you must post the name and phone numbers of the nearest available police station, fire station and rescue unit.

Any time the pool or spa is closed, you must post at least one sign stating “Pool (or Spa) Closed”.

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Spa Signage

Spas need to have special signage that pools do not need to have because of the risks involved with spas mainly due to the high water temperature. Below is the information that must be contained on a spa safety sign:

[Image of spa rules sign]
SECTION VIII: RENOVATIONS

Plan Review and Equipment Replacement

If you are making any major changes or renovations to your aquatic facility, you must get approval from the Michigan Department of Environment, Great Lakes, and Energy (EGLE). Any new or renovated pool must go through plan approval before it opens. Detailed drawings of the pool area need to be included during plan approval.

**Substantial Alterations** are changes that exceed simple equipment changes. These changes include, but are not limited to:

- Change in the basic design (depth, shape, circulation system design)
- Add special feature
- Deck (slope, surface finish, basic design)
- Perimeter barrier (design, height, configuration, routes of access)
- Replacement of the circulation system
- New/relocated dive stand or change in design
- Pipe replacement (all to or from pool)
- Overflow system replacement (50%)

*For questionable situations, call EGLE at Environmental Assistance Center 1-800-662-9278

When replacing old equipment or changing disinfectant types, a “Public Swimming Pool Equipment Change Form” must be completed and submitted to the EGLE. If you are replacing an older device for a newer version, no report needs to be submitted as long as all specifications are identical.

You can find both the Application for Plan Review and the Equipment Replacement Notification Report at https://bit.ly/2XXFdQa
SECTION IX: LIVINGSTON COUNTY
CLOSURE PROCEDURES

Immediate Closure

According to LCHD, a public swimming pool shall be immediately closed if any of the following conditions exist:

- The water clarity is not sufficient to see the main drain.
- The main drain is not secure or is missing.
- The disinfectant level cannot be measured. Chlorine or Bromine not detected and/or pH out of range.
- If none of the following are available: 1) Reach pole, 2) Personal flotation device or 3) Spine board.
- The disinfection and/or equipment is not functioning and in compliance with Michigan Swimming Pool Rules.
- No lifeguard is on duty when required.
- The emergency phone is not accessible or operating properly and is not in compliance.
- The presence of a hazardous object or substance in the swimming pool.
- Cyanuric acid above 80 ppm.
- Positive bacteria sample.

If one of these items exists, then the operator needs to close the pool until the imminent health hazard is corrected. If one of these items is found during an inspection by LCHD, and the operator has not taken action, then the pool will be closed.
Winter Closure Procedures

A public pool should be closed for the winter utilizing one of four methods (listed below). You must lock the entrances, post a “Pool (or Spa) Closed” sign, and meet one of the following:

- Completely drain the pool and provide a perimeter barrier. You must also ensure the facility is inspected by the pool operator twice a month, addressing any problems/violations as necessary.
- Leave the pool filled or partially drained and cover the pool with something that will support 225 pounds of weight. Also provide a perimeter barrier and inspect the facility twice a month in the manner stated above.
- Partially drain the pool. Provide a perimeter barrier 6 feet high and inspect the facility weekly in the manner stated above.
- Partially drain the pool. Provide a perimeter barrier and a person on-site who will have frequent observation over the pool and perform weekly inspections.

If you do not wish to open your pool for the season, you must keep the pool closed in accordance with one of the closure methods.

Enforcement Policy

Public swimming pools and spas, when not properly operated, can create a public health risk through the transmission of disease or injury. Routine maintenance, including required bacteria sampling and submission of monthly operation reports are required and necessary to ensure a healthy swimming environment and be compliant with both the Livingston County Sanitary Code and the State of Michigan Pool Code.

If a public swimming pool is found to be non-compliant with either the Livingston County Sanitary Code or the State Swimming Pool Rules, LCHD will evaluate the violations and may begin to implement the enforcement protocol detailed below.

<table>
<thead>
<tr>
<th>Violation(s)</th>
<th>Enforcement Outcome(s)</th>
<th>Fees Assessed</th>
</tr>
</thead>
</table>
| 2 consecutive non-conforming water samples and/or chronic violation(s) | • Pool closure  
• Complete Risk Control Plan  
• Follow-up inspection  
• Sample collection, if applicable | $100 follow-up inspection  
$25 sample collection & analysis |
| 3 consecutive non-conforming water samples and/or chronic violation(s) | • Pool closure  
• Administrative Conference notice issued  
• Enforcement follow-up inspection  
• Sample collection, if applicable | $500 non-compliance  
$25 sample collection & analysis |
APPENDIX

I. Calculation Surface Area and Pool Capacity

II. Water Balance Adjustment Guide

III. Troubleshooting Common Pool or Spa Problems

IV. Calibrating a Thermometer

V. Public Health Concerns and How are Illnesses Spread at Aquatic Facilities

VI. Livingston County Contact Information and Other Important Contacts
APPENDIX I. CALCULATING SURFACE AREA (IN FT$^2$) AND POOL CAPACITY (IN GALLONS)

Surface Area = Length x Width
Capacity = Surface Area x Average Depth x 7.5

Calculating surface area in square feet is a process of, generally speaking, taking the length multiplied by the width of the pool or spa. However, some pools and spas are not perfect rectangles and need special equations to determine this figure.

To calculate pool capacity, you must first know the surface area and the average depth. In a pool with a constant slope, you determine the average depth by adding the depth of the shallow end to the depth of the deep end, then divide that by 2. However, if a pool does not have a constant slope, you need to calculate the capacity by dividing the pool into sections, provided that each of the sections has its own constant slope. You can then calculate the surface area and average depth for each section, determine the capacity, and add the numbers for all sections together for a total capacity.

See the calculation below for an example of this type of situation.

### SURFACE AREA (SA) CALCULATIONS

Surface area is calculated differently for different shapes. Use these equations to determine your pool or spa’s surface area.

- **SA = L x W**
- **SA = R x R x 3.14 + (L x W)**
- **SA = A x B x 3.14**
- **SA (approximate) = (A + B) x L x 0.45**

### SECTION 1

- **Surface Area = L x W = 10 x 20 = 200 ft$^2$**
- **Average Depth = (8 + 12) ÷ 2 = 10 ft**
- **Capacity = Surface Area x Average Depth x 7.5 = 200 ft$^2$ x 10 ft x 7.5 = 15,000 gallons**

### SECTION 2

- **Surface Area = L x W = 25 x 20 = 500 ft$^2$**
- **Average Depth = (12 + 5) ÷ 2 = 8.5 ft**
- **Capacity = Surface Area x Average Depth x 7.5 = 500 ft$^2$ x 8.5 ft x 7.5 = 31,875 gallons**

### SECTION 3

- **Surface Area = L x W = 15 x 20 = 300 ft$^2$**
- **Average Depth = (5 + 3) ÷ 2 = 4 ft**
- **Capacity = Surface Area x Average Depth x 7.5 = 300 ft$^2$ x 4 ft x 7.5 = 9,000 gallons**

**TOTAL VOLUME = 15,000 + 31,875 + 9,000 = 55,875 gallons**
POOL OR SPA BASIC CALCULATION GUIDE

Pool Name: ______________________________________________________________

Surface Area (SA)* = L X W = __________________________________________________

Average Depth* = __________________________________________________________

*For a pool or spa with multiple sections, calculate surface area and average depth for each section separately.

Total Capacity = SA x Average Depth x 7.5 = __________________________

Minimum Turnover Rate = ____ Hours

Turnover rates are: 8 hrs for pools, 2 hours for wading pools and spray grounds, .5 hours for spas

Flow Rate = Capacity ÷ (Turnover Rate x 60 min/hr) = ___________________

Filter Area Needed = Flow Rate x Filter Media Rate** = ___________________

**See page 11 in the workbook for filter media rates.

Your facility should maintain records that contain information such as pool capacity or volume as well as pool dimensions to help you calculate these items. If you are having problems finding information or need help with calculations, contact Livingston County Health Department 517-546-9858
## Appendix II. Water Balance Adjustment

### INCREASE CHLORINE

<table>
<thead>
<tr>
<th></th>
<th>10,000 GALLONS</th>
<th>40,000 LITERS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DESIRED CHANGE</td>
<td>DESIRED CHANGE</td>
</tr>
<tr>
<td></td>
<td>1 PPM</td>
<td>5 PPM</td>
</tr>
<tr>
<td>Calcium Hypochlorite (67%)</td>
<td>2.0 oz</td>
<td>10 oz</td>
</tr>
<tr>
<td>Sodium Hypochlorite (12%)</td>
<td>10.7 floz</td>
<td>1.7 qts</td>
</tr>
<tr>
<td>Lithium Hypochlorite</td>
<td>3.8 oz</td>
<td>1.2 lb</td>
</tr>
<tr>
<td>Dichlor (62%)</td>
<td>2.1 oz</td>
<td>10.75 oz</td>
</tr>
<tr>
<td>Dichlor (56%)</td>
<td>2.4 oz</td>
<td>12 oz</td>
</tr>
<tr>
<td>Trichlor</td>
<td>1.5 oz</td>
<td>7.5 oz</td>
</tr>
</tbody>
</table>

### INCREASE TOTAL ALKALINITY

<table>
<thead>
<tr>
<th></th>
<th>DESIRED CHANGE</th>
<th>DESIRED CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 PPM</td>
<td>30 PPM</td>
</tr>
<tr>
<td>Sodium Bicarbonate</td>
<td>1.4 lb</td>
<td>4.2 lb</td>
</tr>
<tr>
<td>Sodium Carbonate</td>
<td>14 oz</td>
<td>2.6 lb</td>
</tr>
<tr>
<td>Sodium Sesquicarbonate</td>
<td>1.25 lb</td>
<td>3.75 lb</td>
</tr>
</tbody>
</table>

### DECREASE TOTAL ALKALINITY

<table>
<thead>
<tr>
<th></th>
<th>DESIRED CHANGE</th>
<th>DESIRED CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 PPM</td>
<td>30 PPM</td>
</tr>
<tr>
<td>Muriatic Acid (31.4 %)</td>
<td>13 floz</td>
<td>2.4 qts</td>
</tr>
<tr>
<td>Sodium Bisulfate</td>
<td>2.1 lb</td>
<td>6.4 lb</td>
</tr>
</tbody>
</table>

### INCREASE CALCIUM HARDNESS

<table>
<thead>
<tr>
<th></th>
<th>DESIRED CHANGE</th>
<th>DESIRED CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 PPM</td>
<td>30 PPM</td>
</tr>
<tr>
<td>Calcium Chloride (100%)</td>
<td>0.9 lb</td>
<td>2.8 lb</td>
</tr>
<tr>
<td>Calcium Chloride (77%)</td>
<td>1.2 lb</td>
<td>3.6 lb</td>
</tr>
</tbody>
</table>

### INCREASE STABALIZER

<table>
<thead>
<tr>
<th></th>
<th>DESIRED CHANGE</th>
<th>DESIRED CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>10 PPM</td>
<td>30 PPM</td>
</tr>
<tr>
<td>Cyanuric Acid</td>
<td>13 oz</td>
<td>2.5 lb</td>
</tr>
</tbody>
</table>

### NEUTRALIZE CHLORINE

<table>
<thead>
<tr>
<th></th>
<th>DESIRED CHANGE</th>
<th>DESIRED CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1 PPM</td>
<td>5 PPM</td>
</tr>
<tr>
<td>Sodium Thiosulfate</td>
<td>1.4 oz</td>
<td>7 oz</td>
</tr>
<tr>
<td>Sodium Sulfite</td>
<td>2.4 oz</td>
<td>12 oz</td>
</tr>
</tbody>
</table>

*Always follow the instructions on the manufacturer’s label for exact dosage amounts*
### Appendix III. Troubleshooting Pool Problems

<table>
<thead>
<tr>
<th>PROBLEM</th>
<th>SYMPTOMS</th>
<th>CAUSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLOUDY WATER</td>
<td>Hazy or milky appearance to water. Lack of sparkle.</td>
<td>Disinfection; Circulation; Filtration; Cyanuric Acid; pH; Calcium Hardness; Total Dissolved Solids</td>
</tr>
<tr>
<td>ALGAE GROWTH</td>
<td>Green or almost black spots on the pool/spa walls and bottom or pasty green tint to water.</td>
<td>Disinfection; Circulation; Cyanuric Acid; pH; Filtration</td>
</tr>
<tr>
<td>DIRT ACCUMULATION or SCUM LINE</td>
<td>Debris on pool/spa bottom or on water surface, dark oily film on pool/spa sides.</td>
<td>Circulation</td>
</tr>
<tr>
<td>EYE IRRITATION or CHLORINE SMELL</td>
<td>Dry or itchy eyes. Chlorine smell on skin and in hair.</td>
<td>pH; Circulation; Disinfection</td>
</tr>
<tr>
<td>STAIN FORMATION or DISCOLORED WATER</td>
<td>Brown, red or gray discoloration on pool/spa walls and bottom, rust red or clear green tint to water.</td>
<td>pH</td>
</tr>
<tr>
<td>UNSTABLE pH or HARD TO CHANGE pH</td>
<td>Problem keeping pH within ideal range.</td>
<td>Total Alkalinity; pH</td>
</tr>
<tr>
<td>CALCIFIED FILTER or SCALED HEATER</td>
<td>Excessive flow restriction in filter or heater not caused by oils.</td>
<td>pH; Calcium Hardness</td>
</tr>
<tr>
<td>WATER TASTES SALTY</td>
<td>Salt or brackish taste to water.</td>
<td>Total Dissolved Solids</td>
</tr>
<tr>
<td>GROUT EROSION or PLASTER EROSION</td>
<td>Grout between tiles missing or plaster surface rough and possibly trapping dirt.</td>
<td>pH; Calcium Hardness</td>
</tr>
</tbody>
</table>

### CAUSES

- **CIRCULATION**
  - Run pump continuously. Maintain turnover rates: Pools-8 hrs, Spas-30 min
  - Clean hair and lint trap. Backwash filter. Set valves to minimize restriction.
  - If filter oily, clean with degreaser (tri sodium phosphate)
  - If filter calcified, treat with decalifier. Use sequestrant thereafter.
  - If heater calcified, have heater repaired. Use sequestrant thereafter.
  - Adjust inlet fittings to cause water to rotate slowly in one direction.
  - Equip skimmers with all necessary parts (weirs, equalizers).
  - If pool has gutters, inspect and repair modulation valve on main drain line.

- **FILTRATION**
  - If DE filter, properly coat with DE. Repair any damaged elements.
  - If cartridge filter, replace torn elements. Reseat elements properly.
  - If sand filter, add clarifier to pool/spa water. Inspect and clean sand.
  - Eliminate air leaks on suction side of pump. Check filter air vent.

- **DISINFECTION**
  - Maintain proper disinfection level throughout pool/spa.
  - Adjust circulation to assure uniform distribution of disinfectant.
  - If algae visible, superchlorinate and brush pool/spa surface. Use algaeicide.
  - If eye irritation, superchlorinate.
  - If disinfectant level too high, lower with sodium thiosulphate.

- **CYANURIC ACID**
  - If cyanuric acid level too high, drain and refill or dilute with fresh water.

- **PH**
  - If pH below 6.8, add sequestrant, adjust total alkalinity, add soda ash.
  - If pH below 7.2, add soda ash.
  - If pH above 8.0, add acid.
  - If metal discoloration or staining, use sequestrant. Maintain constant pH.

- **TOTAL ALKALINITY**
  - If total alkalinity below 80 ppm, add sodium bicarbonate.
  - If total alkalinity above 120 ppm, add acid to maintain pH of 7.4-7.6.

- **CALCIUM HARDNESS**
  - If calcium hardness below 200 ppm, add calcium chloride.
  - If calcium hardness above 500 ppm, add sequestrant.

- **TOTAL DISSOLVED SOLIDS**
  - If water tastes salty, drain and refill or dilute with fresh water.
Appendix IV. Calibrating a Thermometer

Because temperature is an important factor in your pool or spa, you need to monitor it carefully. Doing so requires a calibrated thermometer. Calibrating is the process of ensuring that the measurements you are reading are accurate. A simple way to do this is by using the ice water method as illustrated below.

ICE WATER METHOD

INSTRUCTIONS

1. Fill a glass with ice and add cold water
   - This will make the water 32°F.
2. Place the thermometer in ice water and adjust to 32°F.
   - You should see the thermometer’s manufacturer’s instructions on how to adjust the reading. On a stem thermometer like the one shown in the picture above, you can do this by rotating the hex adjusting nut.
3. After adjusting, place in water again to ensure that the thermometer reads 32°F.
Appendix V. Public Health Concerns

HOW ARE ILLNESSES SPREAD AT AQUATIC FACILITIES?
Communicable illnesses can be spread by swallowing, breathing, or having contact with contaminated water from swimming pools, spas, lakes, rivers, or oceans. These illnesses can cause a wide variety of symptoms, including skin, ear, respiratory, eye, and wound infections. The most commonly reported illness caused by exposure during swimming is diarrhea. Diarrheal illnesses can be caused by germs such as Crypto, short for Cryptosporidium, Giardia, Shigella, and E. coli O157:H7.

These illnesses are not spread by contact with blood. Most can be spread:

- By swallowing recreational water contaminated with the illness. Recreational water is water from swimming pools, hot tubs, jacuzzis, fountains, lakes, rivers, springs, ponds, or streams that can be contaminated with sewage or feces from humans or animals.
- Accidentally swallowing something that has come in contact with the stool of a person or animal infected with the germ.
- By swallowing the germ picked up from surfaces (such as lounge chairs, picnic tables, bathroom fixtures, changing tables) contaminated with stool from an infected person.

HOW DO I PROTECT MYSELF AND MY FAMILY?
Healthy Swimming behaviors are needed to protect you and your kids from recreational water illnesses and will help stop germs from getting in the pool in the first place. Here are six “P-L-E-As” that promote Healthy Swimming:

1. PLEASE don’t swim when you have diarrhea.
2. PLEASE don’t swallow the pool water.
3. PLEASE practice good hygiene. Take a shower before swimming and wash your hands after using the toilet or after changing diapers.
4. PLEASE take your kids on bathroom breaks or check diapers often.
5. PLEASE change diapers in a bathroom and not at poolside.
6. PLEASE wash your child thoroughly (especially the rear end) with soap and water before swimming.

CRYPTOSPORIDIUM - CRYPTO
Crypto is a germ that causes diarrhea. Crypto, short for Cryptosporidium, is found in infected people’s stool and cannot be seen by the naked eye. This germ is protected by an outer shell that allows it to survive for long periods of time and makes it resistant to chlorine disinfection found in pools. During the past two decades, Crypto has become recognized as one of the most common causes of waterborne illness in the United States. The germ is found in every part of the United States and the world.

GIARDIA
Giardia is a germ that causes diarrhea. Giardia is found in infected people’s stool and cannot be seen by the naked eye. This germ is protected by an outer shell that allows it to survive outside the body and in the environment for long periods of time. During the past two decades, Giardia has become recognized as one of the most common causes of waterborne illness (drinking water and recreational water) in the United States. The germ is found in every part of the United States and the world.

SHIGELLA
Shigella is a bacteria that causes diarrhea, stomach pain and fever. The Shigella bacteria pass from one infected person to the next. Shigella are present in the diarrheal stools of infected persons while they are sick and for a week or two afterwards. Most Shigella infections are the result of the bacterium passing from stools or soiled fingers of one person to the mouth of another person. Shigella infections can also be acquired by drinking or swimming in contaminated water. Water may become contaminated if sewage runs into it, or if someone with shigellosis swims in it.

E. COLI O157:H7
E. coli O157:H7 is one of hundreds of strains of the bacterium Escherichia coli. Although most strains are harmless and live in the intestines of healthy humans and animals, this strain produces a powerful toxin and can cause severe illness. Bacteria in diarrheal stools of infected persons can be passed from one person to another if hygiene or handwashing habits are inadequate. This is particularly likely among toddlers who are not toilet trained. Water contaminated with this germ could infect a healthy person who comes in contact with it.

*Information obtained from the CDC’s website: www.healthyswimming.org
Appendix VI. Livingston Contact Information

LIVINGSTON COUNTY HEALTH DEPARTMENT

ENVIRONMENTAL HEALTH DIVISION
If you have questions about inspections or your facility or need technical information, call: 517-546-9858

COMMUNICABLE DISEASE
If you need to report an waterborne disease that you feel is affecting your facility’s patrons, contact: 517-546-9850

Certified Pool/Spa Operator® Certification (CPO®) The gold standard of swimming pool operator training, designed and accredited by the National Swimming Pool Foundation. ASK US HOW TO BECOME A CERTIFIED POOL/SPA OPERATOR®

OTHER IMPORTANT CONTACTS...

MICHIGAN REGIONAL POISON CENTER
In emergency situations, DIAL 1-800-222-1222
Children’s Hospital of Michigan

MICHIGAN DEPARTMENT OF ENVIRONMENTAL, GREAT LAKES, AND ENERGY
EGLE Swimming Pools program focuses on pool plan review and pool rule development. To contact EGLE about this program, email DEQ-EH@michigan.gov

CENTERS FOR DISEASE CONTROL AND PREVENTION (CDC)
For information on disease listings and information on waterborne illnesses and how to prevent the spread of them, visit the CDC’s website at: www.cdc.gov