JACKSON COUNTY PUBLIC HEALTH

POOL GUIDE

Disinfection & Breakpoint Chlorination

A guide for responding to fecal accidents, unsatisfactory water, combined chlorine, vomit, blood, and animals in pools.

Disinfection & Breakpoint Chlorination

What is disinfection?

Disinfection means to remove bacteria, parasites, and viruses from the water by sanitizing the pool water. Disinfection is used in the following situations:

- Fecal Accidents
- Unsatisfactory Water Samples
- Vomit or Blood in the Pool Water or on Pool Surfaces.

What is breakpoint chlorination?

Breakpoint chlorination is used to reduce or eliminate combined chlorine. Breakpoint chlorination is adding chlorine to the pool water in quantities large enough to remove the combined chlorine.

This guide provides only minimum requirements. Please contact JCPH or your pool professional and/or chemical supplier for additional information.

Information included is based on CDC and State of Wisconsin Department of Health - Food Safety and Recreational Licensing guidance.

Fecal Accident Disinfection

Fecal accidents contaminate pool water, which can lead to illnesses. These illnesses are spread when swimmers swallow contaminated water.
Disinfection is required when there a fecal accident has occurred in the water.

Disinfection Steps

1. Close the pool and ensure all patrons are out of the water.
2. Remove as much fecal material from the pool as possible. Do not use a vacuum.
3. Test cyanuric acid levels if using stabilizer, pucks/pellets like trichlor or dichlor. Cyanuric acid level must be below 30 ppm. (For outdoor pools only)
4. Turn off disinfectant feeder.
5. Use non-stabilized chlorine to disinfect.
6. Adjust pH to 7.2-7.5.
7. Check proper operation of filtration equipment.
8. Backwash the filters.
9. For whirlpools, drain and refill at this time.
10. Turn on chemical feeders and balance chemicals in this order:
    a. Total Alkalinity
    b. Chlorine
    c. pH
11. Reopen the pool.
12. Complete Fecal Incident Response Form and maintain a copy onsite. View CDC's Fecal Incident Response Guide.

Diarrhea Procedures

- Complete steps for disinfection.
- Clean and brush pool walls, skimmers, and skimmer baskets.
- Increase chlorine level to:
  - 10ppm for 25.5 hours
  - 20ppm for 12.75 hours

Formed Stool Procedures

- Complete steps for disinfection.
- Increase chlorine level to:
  - 3.0ppm for 20 minutes
  - 4.0ppm for 12 minutes
- Complete breakpoint chlorination at the end of the day.

Unsatisfactory Water Test Disinfection

Unsatisfactory water tests occur when disinfectant levels are below minimum requirements and/or the pool filtration system is not working properly. The unsatisfactory test results listed below are indicators that the pool is not being properly maintained.

- Bacterial Counts Above 200 (HPC)
- Positive for Coliform Bacteria
- Positive for E. coli Bacteria

Disinfection Steps

1. Close the pool.
2. Test cyanuric acid levels if using stabilizer, pucks/pellets like trichlor or dichlor. Cyanuric acid level must be below 30 ppm. (For outdoor pools only)
3. Turn off disinfectant feeder.
4. Clean and brush pool walls, skimmers, and baskets. This helps remove biofilms that can seal and trap pathogens that can later be released and cause recontamination.
5. Use non-stabilized chlorine and increase chlorine to 2-10ppm for pools and 3-10ppm for whirlpools.
6. Adjust pH to 7.2-7.5.
7. Check proper operation of filtration equipment.
8. Maintain chlorine and pH levels for at least 1 turnover.
   a. Most pools turnover in 6 hours
   b. Whirlpools turnover in 30 minutes
   c. Wading pools turnover in 2 hours
9. Backwash the filters.
10. For whirlpools, drain and refill at this time.
11. Turn on chemical feeders and balance pool chemicals in this order.
    a. Total Alkalinity
    b. Chlorine
    c. pH
12. Call JCPH to notify sanitarian of reopening pool chemical levels and determine if ok to reopen without sanitarian recheck or sample.
13. Reopen the pool.

Calculating Pool Turnover Rate
Gallons of Pool Water (Volume) / Flow Rate in gpm (Use Flow Meter) / 60 minutes = Turnover in Hours

Breakpoint Chlorination

Combined chlorine comes from sweat, saliva, and urine mixing with the pool water. Combined chlorine can cause water to appear cloudy, chlorine odors, and eye and skin irritation. Make sure to test and record combined chlorine levels twice a week for swimming pools and once a day for whirlpools. Keep combined chlorine levels below 0.4ppm. **Breakpoint chlorination is the only way to remove the combined chlorine from the pool water.**

Breakpoint Chlorination Steps

1. Close the pool.
2. Test cyanuric acid levels if using stabilizer, pucks/pellets like trichlor or dichlor. Cyanuric acid level must be below 30 ppm. (For outdoor pools only)
3. Turn off disinfectant feeder.
4. Clean and brush pool walls, skimmers, and baskets. This helps remove biofilms that can seal and trap pathogens that can later be released and cause recontamination.
5. Test combined chlorine and use only non-stabilized chlorine. To determine the amount of chlorine to add, multiply combined chlorine by 10. For example, if combined chlorine is 2.0ppm, then increase chlorine levels to 20ppm.
6. Adjust pH to 7.2-7.5.
7. Check proper operation of filtration equipment.
8. Maintain chlorine and pH levels for at least 2 turnovers.
   a. Most pools turnover in 6 hours
   b. Whirlpools turnover in 30 minutes
   c. Wading pools turnover in 2 hours
9. Backwash the filters.
10. For whirlpools, drain and refill at this time.
11. Turn on chemical feeders and balance pool chemicals in this order
    a. Total Alkalinity
    b. Chlorine
    c. pH
12. Reopen the pool.

Calculating Pool Turnover Rate
Gallons of Pool Water (Volume) / Flow Rate in gpm (Use Flow Meter) / 60 minutes = Turnover in Hours

If using a non-chlorine shock product to reduce combined chlorine levels, make sure you have the proper testing chemicals to eliminate the interference from the shock chemicals.

Vomit, Blood, & Animal Response

Vomit in Pool Water

Vomiting can occur when swimmers swallow pool water. If a swimmer vomits water, no special disinfection is required. If the swimmer vomits their stomach contents, then follow the directions for a formed stool fecal accident to properly disinfect the pool water.

Blood in Pool Water

Blood in properly chlorinated pool water is not a safety risk to swimmers because the chlorine will kill germs on contact. Closing the pool is not necessary. Due to public perception, some pool managers may temporarily close the pool to satisfy customer concerns.

Blood, Feces, or Vomit on Pool Surfaces

Body fluids, including blood, feces, and vomit are all considered potentially contaminated with germs. Therefore, spills of these fluids on the pool deck should be cleaned up and the contaminated surfaces disinfected immediately.

Blood Spill Kit

- Disposable Gloves
- Chlorine Disinfectant
- Biohazard Disposable Bags
- Absorbent Material to Contain the Spill

See First Aid and Blood-Biohazard Kit Contents for additional items required.

Animals

Birds, raccoons, and dead animals in the pool water can be problematic. Read more information from the CDC.

Breakpoint Chlorination Worksheet

Step 1: Total Chlorine - Free Chlorine = Combined Chlorine

Step 2: (Combined Chlorine x 10) - Free Chlorine = ADJUSTMENT

Step 3: Use Chemical Adjustment Worksheet Below

Amount of Chemical (from product label or page 10)	Actual Pool Volume in Gallons	Desired Chemical Change	Total
	÷	÷	
	Divide by 10,000 Gallons	Divide by _____ppm	
	✕	✕	=

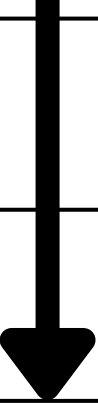**Step 1: Total Chlorine - Free Chlorine = Combined Chlorine**

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Chemical Adjustment Worksheet

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↓	÷	÷	
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	✕	✕	=

Calculation Formulas

AMOUNT CONVERSIONS

Ounces to Pounds	Ounces/16 = Pounds
Fluid Ounces to Gallons	Fluid Ounces/128 = Gallons

DISTANCE CONVERSIONS

Yards to Feet	Yards x 3 = Feet
Meters to Feet	Meters x 3 = Feet

SURFACE AREA

Rectangle/Square	Length x Width = Square Feet
Circle	3.14 X Radius x Radius = Square Feet

POOL VOLUME

Rectangle	Length x Width x Average Depth x 7.5 = Gallons
Circle	3.14 X Radius x Radius x Average Depth x 7.5 = Gallons
Average Depth	(Shallow/Deep)/2 = Average Depth

TURNOVER RATE

Pool Volume / Flow Rate / 60 = Hours

FLOW RATE

Pool Volume / Turnover Rate (hrs) / 60 = Gallons Per Minute (gpm)

FILTER SURFACE AREA

Flow Rate / Filter Media Rate = Square Feet

HEATER SIZING

Pool Volume x 8.33 X Temperature Adjustment = BTU

Chemical Adjustment Measurements

Chemical	Amount	10,000 Gallons
Chlorine Adjusters		
Gas Chlorine	1.3 oz	1 ppm
Calcium Hypochlorite	2.0 oz	1 ppm
Sodium Hypochlorite	10.7 fl oz	1 ppm
Lithium Hypochlorite	3.8 oz	1 ppm
Dichloro-s-triazinetrione (62%)	2.1 oz	1 ppm
Dichloro-s-triazinetrione (56%)	2.4 oz	1 ppm
Trichloro-s- triazinetrione	1.5 oz	1 ppm
Chlorine Neutralizers		
Sodium Thiosulfate	2.6 oz	1 ppm
Sodium Sulfite	2.4 oz	1 ppm
Total Alkalinity Adjusters		
Sodium Carbonate	14 oz	10 ppm
Sodium Bicarbonate	1.4 lbs	10 ppm
Sodium Sesquicarbonate	1.25 lbs	10 ppm
Muriatic Acid (31.4%)	26 fl oz	10 ppm
Sodium Bisulfate	2.1 lbs	10 ppm
Calcium Hardness Adjusters		
Calcium Chloride (100%)	0.9 lbs	10 ppm
Calcium Chloride (77%)	1.2 lbs	10 ppm
Stabilizer Adjusters		
Cyanuric Acid	13 oz	10 ppm

**** Use information provided on product label first. If product label is missing, use chart above.

Helpful Resources

DATCP Pool Homepage:

https://datcp.wi.gov/Pages/Programs_Services/WaterRecreation.aspx

CDC Healthy Swimming:

https://www.cdc.gov/healthywater/swimming/index.html

ATCP 76:

https://docs.legis.wisconsin.gov/code/admin_code/atcp/055/76

Pool & Hot Tub Alliance:

https://www.phta.org/