NARCH Guidance for water management

All NARCH guidelines follow PWTAG code of practice: https://www.pwtag.org/download/pwtag-code-of-practice/?wpdmdl=2378&refresh=61483edc46a791632124636

Daily you should:

- Test the pool water at least 3 times per day for a standard 8-hour day when the pool is operational but more for longer operational hours or if re-tests are required following the addition of chemicals. The first test must be carried out before you use the pool that same day.
- Test treadmill water 2 hourly (unless pool-fed) as water tank volume is typically 1600-1800L and things can change quickly in the small volume of water. The first test must be carried out before you use the treadmill that same day.
- On non-operational days, pool and treadmill water should be tested daily with a re-test required following the addition of chemicals.
- The following should be recorded when testing:

Free chlorine

  - Total chlorine or bromine
  - Combined Chlorine
  - pH
  - Temperature
  - Water quality appearance (crystal clear, blue/clear, grey/clear, dull)
  - Bather load (human/animal)
  - Date and time of test
  - Who did the test?
  - Any action taken
  - Re-test results if chemicals added

Note: Action taken may include the addition of any chemicals, the quantity of chemicals added, cleaning of pump baskets/skimmer baskets, backwashing

Weekly you should:

- Backwash or clean filters (more often in pools/water treadmills with a heavy load or low water volume and whenever the pressure across the filter media bed reaches the level specified by the filter manufacturer, at the end of the day)
- Coagulant dosing (flocculant)
- Shock dosing for oxidation
- Test calcium hardness, total alkalinity and total dissolved solids and use these in addition to pH and water temperature to calculate LSI to appraise whether the water is corrosive or scale forming (see 'Maintaining Water Balance' below)
- Review test results/patterns and adjust standard operating procedures if necessary to maintain correct disinfection levels
- If you are using stabilized chlorine, test Cyanuric Acid levels at least monthly. Cyanuric acid accumulates in the water slowing down the effectiveness or speed at which the chlorine reacts and making the chlorine ineffective. To prevent this, the cyanuric acid content must be reduced to acceptable levels by dilution with fresh water.

Monthly you should:

- Send a sample of both pool/water treadmill water for microbiological water testing. The testing should include Total Viable Count (TVC), Coliforms / E. Coli and Pseudomonas Aeruginosa.

Acting on failures: When to close the pool/treadmill:

- If a microbiological result is unsatisfactory. Appropriate action should be taken, and a re-test should be repeated as soon as practicable.
- If the second result is also unsatisfactory, the water management and operation should be investigated and the test repeated.
- If the third result is still unsatisfactory, immediate remedial action is required, which may mean closing the pool/treadmill.
- The pool/treadmill should be 'closed' if there is chemical or physical evidence of unsatisfactory disinfection.
- The pool/treadmill should be 'closed' if microbiological testing discloses gross contamination*. Gross contamination is indicated by either:
    - E. Coli over 10 per 100ml PLUS either colony count over 10cfu per ml or P. Aeruginosa over 10 per 100ml (or, of course, both) or
    - P. Aeruginosa over 50 per 100ml and a colony count over 100 per ml.
- Closure procedures for microbiological failure should be included in the pools Emergency Operating Procedures

*In the event of gross contamination, the pool/treadmill must be immediately closed and a sequence of backwashing, shocking, adding flocculant and specific cleaning measures is required. Then run for 6 turnover periods while maintaining optimal water chemistry and coagulant (flocculant) dosing. After this period, the pool/treadmill water should be re-sampled and await the 24-hr interim report. All equipment used within the pool//treadmill, including pool cover must be cleaned with a 10ppm chlorine solution before using in the pool/treadmill to prevent re-contaminating the water.

For guidance on the frequency of microbiological testing, interpreting results and recommended actions go to Hydrotherapy Pool Water Safety | Water Treatment Services

Quarterly you should:

- Send a sample of pool/treadmill/shower water for Legionella testing as indicated as necessary by your legionella risk assessment.

For more information on legionnaires disease testing follow these links: Managing legionella in hot and cold water systems (hse.gov.uk) and HSE - Legionella and Legionnaires' disease

Annually you should:

- Service all electrical and mechanical equipment
- Test/calibrate water testing equipment.
- Change the filter agent if required (not all filter agents need to be changed every year, but filter efficiency (pump pressure), water quality and the presence of 'channeling' in the filter media should be assessed to determine the right time for filter agent change).

Updated: Feb 2025

When required:

Shocking (Super Chlorination) should be carried out if a problem has been identified (this will vary between pools/treadmills and advice should be sought from your own pool/treadmill engineer if you have any queries). For example, chlorine dioxide tablets may be recommended if there are continual micro failures as this will remove biofilms much more efficiently than shocking – especially good in treadmills.

Reasons to shock could be:

- If the combined Chlorine (Chloramines) are above half of the free chlorine level or above 1ppm, as per the PWTAG COP 9.7, shocking should resolve this and reduce/remove the chloramines.
- Microbiological test fail, with retest performed as soon as practically possible.
- If Cryptosporidium is present.
- If Algae is present.
- Other sources of contamination, such as organic matter, or a runny faecal incident (PWTAG state that if a solid faecal incident occurs and the pool/treadmill is operating well with good pH and disinfectant level then no further action is required).
- If, following water balance/LSI calculation your pool water quality is poor.

Shocking to 10 ppm by following the manufacturer instructions provided on the shock chemical container.

Shocking need only be followed by de-chlorination if allowing sufficient time for residuals to fall to acceptable levels has not been sufficient.

In the case of Cryptosporidium being present, shocking to 20ppm is required.

Maintaining water balance

It is important to maintain the water balance for you and your patient's comfort, care of the pool fittings and longevity equipment.

What is Balanced Water?

A water is said to be in balance when it is neither corrosive nor scale forming. This is calculated using the Langelier Saturation index, which is a simple and reliable formula and will tell you if the water is in balance, corrosive or scale forming. It uses various test parameters, each of which is given a factor – these are fed into a formula to give an index value. A zero reading means the water is balanced, positive reading scale forming and negative reading corrosive.

What tests do you need to measure and what is the formula?

Five tests need to be carried out as follows: pH, total alkalinity, calcium hardness, total dissolved solids (TDS) and temperature (please note that disinfection levels play no part in the balanced water calculation). Once you have the readings and allocated the factors the following formula is used:

pH + Total Alkalinity Factor + Calcium Hardness Factor + Temperature Factor – TDS Factor

The factors can be worked out from tables like the one shown below or there are various Apps now available that will calculate the result for you.

Temperature Deg C	TF	Calcium Hardness PPM	CF	Total Alkalinity PPM	AF	TDS PPM	TDSF
0	0.0	50	1.3	5	0.7	0	12.0
3	0.1	75	1.5	25	1.4	1000	12.1
8	0.2	100	1.6	50	1.7	2000	12.2
12	0.3	150	1.8	75	1.9	3000	12.25
16	0.4	200	1.9	100	2.0	4000	12.3
19	0.5	250	2.0	125	2.1	5000	12.35
24	0.6	300	2.1	150	2.2	6000	12.4
29	0.7	400	2.2	200	2.3		
34	0.8	600	2.35	300	2.5		
41	0.9	800	2.5	400	2.6		
53	1.0	1000	2.6	800	2.9		

The aim is to adjust the parameters as required to obtain a balanced water. Ideally, you would be looking for a zero (balanced) or slightly positive reading (slightly scale forming water) as this would mean a small protective coating would form on the pipework, fittings etc. A negative (corrosive) reading is not desired. Generally, low levels give corrosive conditions and high scale forming – the trick is to balance these.

Example Calculations:

Sample 1		Sample 2	
Reading	Factor	Reading	Factor
pH 7.2	7.2	pH 7.3	7.3
Total Alkalinity 15ppm	1.1	Total Alkalinity 100ppm	2.0
Calcium Hardness 15ppm	0.7	Calcium Hardness 500ppm	2.3
Temperature 29	0.7	Temperature 29	0.7
Sub Total	9.7	Sub Total	12.3
TDS 2000ppm	12.2	TDS 1500ppm	12.15
Index Value	**- 2.5**	**Index Value**	**+0.15**

Sample 1 indicates very aggressive water as you would expect, as both the alkalinity and calcium hardness is very low. It would be advisable to try to raise these, if possible, to bring the water back into balance. If we assume the free chlorine level in this pool was 1.5ppm and total alkalinity 2.0ppm, if you were only measuring chlorine and pH, you might believe that everything was good within the pool. However, with a water this aggressive and in this poor a condition the damage being caused could be considerable

Sample 2 gives a slightly scale forming water and indicates an ideal Index value. Here most parameters are well within recommended levels so no action would be needed.

Please note disinfectant does not play a part of the balanced water test but it is essential that regular testing is carried out and levels are maintained as per guidance.

Free mobile phone Apps are available to help you input data and calculate LSI for example, https://www.pool-chem.co.uk/lsi-calculator-app

Recommended levels:

The values below require validation by satisfactory bacteriological water quality standards.

For all pools/treadmills using hypochlorite, assuming the pH value is 7.0 to 7.2, the free chlorine levels should be maintained at 1mg/l provided that a satisfactory bacteriological quality can be maintained.

Where pH values of 7.0 to 7.2 cannot be achieved, operators must increase the concentration of free chlorine to 2.0 mg/l for pH 7.2 to 7.4

Free Chlorine – ideal is 2ppm-4ppm. Do not treat dogs if < 1ppm. If free Chlorine levels reach 5ppm then dosing should be stopped, if they continue to rise above 6ppm then sessions should be stopped until levels have reduced.

Combined chlorine - Ideal level is zero. Acceptable - No more than 1ppm or half the free chlorine

Bromine 4ppm-6ppm. Do not treat dogs if < 2ppm or > 10 ppm

pH: 7.0 - 7.6 acceptable (7.0 – 7.2 ideal)

TDS - should be no more than 1500mg/l. TDS should not be allowed to rise more than 1,000mg/l above the level in the source water.

Total Alkalinity - Ideal 80 – 140ppm. Acceptable range 80 – 200ppm

Calcium Hardness -Ideal around 200ppm. Acceptable range: 80 – 200ppm

Cyanuric acid - For pools using chlorinated isocyanurates as disinfectants, cyanuric acid levels should be below 100ppm.

Temp: The safe and comfortable temperature range is 28–31^{0}C. However, it is strongly advised to maintain at 29-30^{0}C to obtain maximum therapeutic benefits for patients. If the hydrotherapy environment is particularly warm, e.g. in hot weather conditions, it is advisable to keep the water temperature at 28-29^{0}C.

For more information: [PWTAG Standards and Guidance | Pool Water Treatment Advisory Group]

Approved equipment for testing:

- Photometer

NB. Pool and Spa test strips and Comparators may only be used as a backup in the event of a photometer malfunction.

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National Association of Registered Canine Hydrotherapists

Traffic light system

Reading	Red	Amber	Green	Amber	Red
pH	< 6.95 Close the pool until it is back in range. Add pH raiser	6.95- 6.99 The pool can open. Check the dose of automated system or hand dose pH raiser	7.0 -7.2 No action is required. Continue to monitor	7.3- 7.6 The pool can open. Check the dose of automated system or hand dose pH reducer	> 7.6 Close the pool until it is back in range. Add pH reducer
Free Chlorine	< 0.5ppm Close the pool until it is back in range. Add chlorine dose	0.6 – 0.9ppm The pool can open. Check dose of automated system or hand dose chlorine	1.0 – 2.0ppm No action is required. Continue to monitor	2.1 – 5.99ppm The pool can open. If automated, check the dosing system and reduce dose and/or dilute pool with fresh water	> 6.0ppm Close the pool until it is back in range. Dilute pool with fresh water
Combined Chlorine	Pool can open	Pool can open	Zero < 50% free chlorine No action is required. Continue to monitor	0.4 – 1.0ppm	> 1ppm Close the pool until it is back in range.
Bromine	< 2.0ppm Close the pool until it is back in range. Add Bromine dose	2.1 – 3.9ppm The pool can open. Check dose of automated system or hand dose Bromine	4.0 – 6.0ppm No action is required. Continue to monitor	6.1 – 10ppm The pool can open. Check the dose of automated system and/or dilute pool with fresh water	>10ppm Close the pool until it is back in range.
Total Alkalinity	< 80ppm Close the pool until it is back in range. Add TA Raiser dose	The pool can open. Add TA Raiser dose	80-200ppm No action is required. Continue to monitor		>200ppm Close the pool. Check source, water level - backwash

Amber Zone Readings – chemical/water action, then after 30 mins, take a fresh sample and test.

Red Zone Readings – close the pool – take action to resolve. Take a fresh sample and test.

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Reading	Red	Amber	Green	Amber	Red
Calcium Hardness	<50ppm Close the pool until it is back in range. Consider changing to a calcium-based disinfectant – seek advice from PWTAG	< 50-79ppm The pool can open. Add Calcium Raiser dose	80-200ppm No action is required. Continue to monitor	201-249 ppm The pool can open subject to water supply hardness. Seek advice from PWTAG about adding Sodium Chloride softener	>250ppm Close the pool. Check source, water level - backwash
Cyanuric acid (For pools using chlorinated isocyanurates as disinfectants)			30-100ppm No action is required. Continue to monitor		>100ppm Close the pool. Check source, water level - backwash
TDS			<1000 above incoming water supply range No action is required. Continue to monitor		>1500 Close the pool. Check source, water level – backwash more frequently
Water Temperature	<28^{0}C Close the pool until it is back in range.	28-28.9^{0}C	29-30^{0}C No action is required. Continue to monitor	30.1 -39.9^{0}C	>31^{0}C Close the pool until it is back in range.

Amber Zone Readings – chemical/water action, then after 30 mins, take a fresh sample and test.

Red Zone Readings – close the pool – take action to resolve. Take a fresh sample and test.