

## Basic Pool Care

Guidelines on running a privately owned swimming pool for those using chlorine sanitizers

1. *Preliminaries*
2. *Basic Pool Care*
3. *Recommended Maintenance Program - Swimming Pool Chemicals*
4. *Recommended Maintenance Program - Swimming Pool Hardware*

### 1. PRELIMINARIES

- Buy a good chemical test kit
- Calculate the volume of water in your pool using the formulae
  - For rectangular pools - Length x Width x Ave depth (in feet) x 6.25 = volume in gallons
  - For round or oval pools - Length x Width x Ave depth (in feet) x 4.9 = volume in gallons

To convert to cubic metres, divide the answer by 220. Jot the figure down and keep it in a safe place. It is the foundation stone for sound pool management.

### 2. BASIC GUIDELINES

A man I knew who had run a pool centre for many years used to send his customers away with a note on the back of an envelope telling them what to do to keep their swimming pool water in good condition for the season. He had written down two figures - the daily dose of chlorine required for the size of pool concerned, and what to do if the pH strayed outside the normal parameters.

These are the most important factors in achieving good water quality. As an absolute minimum, you should aim to:

#### 1. MAINTAIN FREE CHLORINE LEVELS

Make sure free chlorine never falls below 1.0ppm. This is to kill harmful germs and algae.

#### 2. SHOCK DOSE

Superchlorinate the pool once a fortnight to bring the free chlorine up to 6-10ppm, using a shock chlorine. This will break down chloramines and organic pollution.

#### 3. CHECK THE pH

Correct the pH if it falls below 7.2 or rises above 7.6. Correct pH will ensure the chlorine is working effectively.

Many of the demonstration pools you see at pool center's do no more by way of day to day maintenance than that. Most pool water disorders occur when there is no chlorine in the water, or when the pH has strayed. For best results, however, it is strongly recommended that you should also keep a watch on:

- Water balance; the most important features of which are:
  - pH - as above
  - Total Alkalinity. Low alkalinity can make it difficult to maintain the pH. High alkalinity can lead to cloudy water or scale on the surfaces.
  - Calcium Hardness, Correct calcium hardness will help protect pool surfaces.
- Cyanuric Acid (stabiliser). You need enough stabiliser to prevent waste of chlorine to sunlight, but not so much that it impairs the effectiveness of the chlorine.

For pools using stabilised chlorine donors:

A detailed program for pool maintenance is suggested in the next section

### 3. RECOMMENDED MAINTENANCE PROGRAM - CHEMICALS

- Free Chlorine  
Test daily (or more often in hot, sunny weather when the pool is in heavy use). The free chlorine reading using the DPD No. 1 test tablet should be between 1.0 - 2.5ppm (or up to 4 - 5ppm for pools using stabilised chlorines like dichlor and trichlor).

*Dose rate*

- For dichlor - 125g per 15,000 gallons to raise free chlorine by 1ppm
- For trichlor - recharge the skimmer or feeder device with tablets and control chlorine levels by adjusting the water flow
- For calcium hypochlorite - 100g per 15,000 gallons to raise the free chlorine by 1ppm
- For sodium hypochlorite - 0.4 of a litre per 15,000 gallons to raise the free chlorine by 1 ppm

- Superchlorinate  
Once a fortnight, superchlorinate, preferably with unstabilised chlorine such as calcium hypochlorite or calcium hypochlorite to raise the free chlorine to 6-10ppm. Calculate the dose rate from the figures in the preceding section.  
***WARNING: NEVER MIX DIFFERENT TYPES OF CHLORINE TOGETHER BEFORE DOSING, AND DO NOT ALLOW THEM TO MEET IN A CONCENTRATED FORM. IF SUPERCHLORINATING VIA THE SKIMMER, ENSURE THAT ANY CHLORINE TABLETS ARE REMOVED FROM IT FIRST.***

- pH  
Test daily (or more often in hot, sunny weather when the pool is in heavy use). The pH reading using the phenol red test tablet should be between 7.2 and 7.6 (or as near the mid-point - 7.4 as possible).

*Dose rate*

- To raise pH - 0.7kg of soda ash (sodium carbonate) per 15,000 gallons per day until the correct reading is obtained.
- To lower pH - 0.7kg of dry acid (sodium bisulphate) per 15,000 gallons per day until the correct reading is obtained. Dose the dry acid by dispersing over as wide an area of the pool as possible.

- Total Alkalinity  
Test once a month. The alkalinity reading using the Alkalinity M tablet count test should be between 100-200ppm for pools using stabilised chlorines; 80-120ppm for calcium hypochlorite or 120-150ppm for sodium hypochlorite.

*Dose rate*

- To raise the alkalinity - 2kg of sodium bicarbonate per 15,000 gallons per day until the correct reading is obtained.
- To lower the alkalinity - 1.4kg of dry acid (sodium bisulphate) per 15,000 gallons per day until the correct reading is obtained. Dose the dry acid in one spot in the pool - in this way it will affect alkalinity more than pH

- Calcium Hardness  
Test two or three times a season. The calcium hardness reading using the tablet count test should be above 350ppm - the top limit is not too important.

*Dose rate*

- To raise the calcium hardness, add calcium chloride flakes at the dose rate recommended on the pack. If it is difficult to keep calcium hardness above 350ppm, you should consider changing to calcium hypochlorite as your principal pool sanitiser

- Cyanuric Acid  
Test once a fortnight. The cyanuric acid (stabiliser) reading using the turbidity/disappearing dot test should be a minimum of 30ppm to prevent decomposition of chlorine to sunlight in outdoor pools. The maximum level is a matter of debate - most professionals take the view that the performance of the chlorine is adversely affected if cyanuric acid goes above 160ppm. Dept of the Environment guidelines are for a ceiling of 200ppm. Best to aim for the lower figure - 160ppm.

*Dose rate*

- To raise the stabiliser level (which will usually only be necessary in pools on unstabilised chlorines) - 2kg of cyanuric acid per 15,000 gallons.
- To lower the stabiliser level - there is no chemical additive to achieve this. You will need to replace part of the pool water with fresh. The volume of water to be replaced will be *pro rata* e.g. to lower the stabiliser level from 180ppm to 160ppm, it will be necessary to replace just over 10% of the water.

#### 4. RECOMMENDED MAINTENANCE PROGRAM - POOL HARDWARE

- Cycle time  
In general, the longer the pool water is being filtered, the better it cleans the water. As a minimum, run the circulation pump continuously when bathers are in the pool, and for four hours out of twelve at all other times.
- Filter  
The purpose of the filter is to trap suspended particles in the sand or other media and stop them getting back into the pool. It is essential that the efficiency of the filter is not impaired. Follow the manufacturer's instructions and backwash it (i.e. reverse the flow and drain the dirt that has accumulated on the top of the media to waste). This should be done at least once a fortnight, but watch the pressure gauge and do it more often if necessary. Sand should need renewal every 7 to 10 years.

Check that flow through the pump strainer is not impeded by rubbish as part of the backwash routine.

- Skimmers  
Clean the skimmers once a week taking out leaves and anything else that could obstruct the water flow.

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- Vacuuming  
If you are not operating an automatic pool sweep, vacuum the pool once a week to remove solids that are not floating in suspension. Some (aluminium-based) water clarifiers will drop accumulated solids to the bottom of the pool, and vacuuming may be required shortly after treatment - see the instructions on the pack. Exclude air from the vacuum hose before connecting it to the attachment in the skimmer.
- Brushing  
Brush the sides and bottom of the pool frequently, ensuring that any algae that may be discoloring the tiles, grouting or liner is removed (look for this around the steps, under-water lights and 'dead spots' where water movement is minimal). Brush towards the drain so that debris and dirt is drawn into the hopper and onto the filter.
- Tide Marks  
Clean dirt from the water line with a chlorine compatible tile and liner cleaner if it appears. Greasy deposits can act as breeding sites for algae.

## Swimming Pool Water Problem Solving Guide

For those with privately owned swimming pools using chlorine sanitisers it can be difficult to make an accurate diagnosis for any particular problem with pool water. It is usually a case of considering several possibilities and selecting the most likely cause from other evidence, such as water tests. Browse through the various explanations for each symptom and see which you think is most likely to be responsible.

The problems are grouped together in the menu below. Click on the relevant category and scroll to find more details on your particular pool problem:

- Water Quality Problems
  - Cloudy, milky water
  - Green water
  - Rusty water
- Bather discomfort, including sections on eye sting, chlorine allergy
- Chlorination problems
- Water balance problems, including sections on pH, alkalinity
- Problems with pool surfaces
- Filtration problems

### WATER CLARITY PROBLEMS

**SYMPTOM:** Cloudy/milky Water. There are four possible causes - your test kit will give you the best idea as to which is the most likely.

- First possible cause:  
Fine suspended particles floating in the water can lead to a milky white discoloration. This will probably be due to a precipitation of dissolved hardness salts as result of high pH or high total alkalinity, or both. (Precipitation is a process where dissolved minerals become transformed into very small solid particles).  
To Remedy:

- Lower the pH or alkalinity using dry acid. To correct pH, add dry acid at a rate of 1kg per 100 cubic metres (22,000 gallons) per day until correct reading is obtained. To correct alkalinity, the dose should be doubled. It is important to add the acid a little at a time and pre-dissolved at a dilution no stronger than 8:1.
- Second possible cause:  
Build up of dirt and bather pollution due to insufficient chlorine or poor filtration  
To Remedy:
  - Backwash filter, then superchlorinate by adding unstabilised chlorine such as sodium hypochlorite or calcium hypochlorite to raise the free chlorine to 10ppm.
  - Add a clarifier to polish the water.
- Third possible cause:  
The effectiveness of the chlorine has been reduced in pools using stabilised chlorine donors because the water is over-stabilised i.e. the levels of stabiliser (cyanuric acid) are too high. This prolongs the time it takes to kill organisms (bugs) which can proliferate and lead to haziness in the water.  
To Remedy:
  - Replace some of the pool water by draining to waste (or carrying out an extra large backwash), then top up with fresh mains water. This will lower levels of stabiliser.
  - Superchlorinate to 10ppm using the products recommended above.
- Fourth possible cause:  
The filter is blocked or is ineffective  
To Remedy:
  - Check sand and replace if necessary. Your dealer should be called in if you do not feel equal to the task.
  - Sand particles can become coated with calcium in some circumstances, especially in hard water areas. If the filter is not blocked and seems all in order in all other respects, treat with a filter cleanser to sharpen the sand.

**SYMPTOM: Cloudy/green Water.**

- Probable cause:  
At some stage, chlorine levels have fallen, or chlorine has become ineffective, allowing algae to colonise the water.  
To Remedy:
  - Shock dose with an unstabilised chlorine such as calcium hypochlorite or sodium hypochlorite, or use an algaecide. Shock dosing usually produces the fastest results. For greenish discolorations (where the water is no more than tinted green), superchlorinate to 10ppm. For more serious problems, where the water is pea-soup green and the bottom is invisible, shock dose up to around 25ppm. This will kill the algae.
  - Brush off any algae that may remain on pool surfaces. Look for colonies behind step ladders and around underwater lighting.
  - Backwash the filter 24 hours later to remove dead algae from the top of the filter media.
  - Any remaining haziness in the water should be removed by using a water clarifier. The cationic clarifiers are best in this situation.
  - Thereafter maintain chlorine at around 3ppm to prevent a recurrence.
  - If the pool is particularly susceptible to algae, consider regular use of an algaecide or chlorine with added algaecide.

**SYMPTOM: Rust red Water.**

- Probable cause:  
Steel or ferrous metal fittings in the circulation system e.g. pipes are being corroded by low

pH. A shock dose of chlorine will then oxidise the ferrous particles creating rust. This can often happen after re-opening a pool.

To Remedy:

- It is necessary to act very quickly to prevent consequential damage such as staining of the liner, if fitted. Contact your pool installer or pool dealer to see if it is safe to drain down and replace the water all in one go, or whether this should be done by progressive dilution.
- Remove any rust staining from the pool surfaces with a good tile and liner cleaner.
- Replace the ferrous metal fittings using PVC or copper.
- Ensure the fresh water is properly balanced i.e. that pH and total alkalinity are within recommended parameters.

## BATHER DISCOMFORT PROBLEMS

- Stinging eyes, sore throat and skin irritation
- Blond or tinted hair turns green
- Allergy to chlorine

SYMPTOM: Stinging eyes, sore throat and skin irritation. There are three possible causes - use your test kit to see which is the most probable.

- First possible cause:

This could well be a pH problem - the water could be too acidic or too alkaline. The pH of the human eye is around 7.4-7.5 - anything higher or lower will irritate. The problem would be made worse if the pH is out to the extent that it changes the species of chlorine (see pH explained)

To Remedy:

- Correct the pH. To lower the pH, add dry acid at a rate of 1kg per 100 cubic metres (22,000 gallons) per day until correct reading is obtained. To raise pH, dose at the same rate not with dry acid, but with soda ash.

- Second possible cause:

High combined chlorine. Chloramines are known to be an irritant. Note carefully the results you get on your DPD no3 test. Also, if you get an unpleasant chlorine smell, its odds on that the problem is due to high chloramines.

To Remedy:

- Break the chloramines down by super chlorinating the pool with up to 10ppm free chlorine.
- Aim to allow no more than one third of the total chlorine to be in the form of combined chlorine.

- Third possible cause:

Some detergents used for cleaning pool sides and removing scum lines (tide-marks) are incompatible with chlorine. This can unfortunately include many products sold specifically for this application. The resulting reactions in the water can lead to eye and skin irritation. Similar reactions can occur if soaps or shampoos get into the water, for instance if bathers jump in to rinse off.

To Remedy:

- Superchlorinate to react-out the detergents.
- Change to cleaners that are chlorine compatible or abandon their use and resort to a little elbow grease.

SYMPTOM: Blond or tinted hair turns green.

- Probable cause:

High levels of copper in the pool. This can arise either because of over-use of copper based algacides, or because the pH of the pool water has been allowed to drop to a point at which it starts to corrode the copper fittings in the heater.

To Remedy:

- Correct the pH. To raise the pH, add soda ash at a rate of 1kg per 100 cubic metres (22,000 gallons) per day until correct reading is obtained.
- Your pharmacist should be able to recommend a shampoo to remove the unwanted pigment (and dated punk image)

SYMPTOM: Allergy to chlorine.

- Possible explanations:

The most important thing is to make sure that you really are suffering from a genuine allergy and not something else. The discomfort you feel could be due to other factors. For instance, it is due to the fact that the pH of the water is too low or too high. Alternatively it could be due to high levels of combined chlorine (chloramines) - chloramines are known to be irritants. Both these things are explained in more detail in 'Stinging eyes, sore throat and skin irritation' on this page). Test the water for pH and chloramines and correct as necessary.

Also, be your own guinea pig - use another pool sanitized with chlorine and see if you get the same reactions. If not, your problems are probably more to do with water treatment.

Bear in mind as well that chloramines are formed by the breakdown of nitrogenous compounds such as perspiration, cosmetics, mucous etc when hypochlorous acid (free chlorine) reacts with them. The chloramines are eventually broken down by more hypochlorous acid to form harmless substances such as nitrogen gas. All this usually takes place in the pool water. However, the breakdown reactions can take place on the surface of the skin if for instance you have been working-out and sweating before swimming or using cosmetic preparations. Remove these nitrogenous compounds from your skin by taking a shower and washing thoroughly before entering the pool. The chances are you will find the pool water much more comfortable.

If neither of these suggestions helps, then the likelihood is that you are one of the minorities who experience an allergic reaction to chlorine. An allergy is defined as hypersensitiveness to some foreign substance, small doses of which produce a violent and disproportionate reaction in the sufferer. Chlorine is unlikely to have been the original or primary allergen, but those suffering from allergies can unfortunately find themselves sensitised by chlorine

To Remedy:

- If you think you have a genuine allergy, then sadly the only remedy is to change to a non-chlorine sanitiser. Be warned that a number of these require to be dosed or shock dosed with chlorine. Consult your pool dealer for suitable alternatives.

## PROBLEMS WITH CHLORINE LEVELS

- Inability to get a chlorine reading on the test kit
- The chlorine reading is difficult to maintain

SYMPTOM: Chlorine has been added to the water, but there is no reading on the test kit.

- Probable cause:

The chlorine level in the pool is so high that it bleaches the colouring agent in the test tablet. To confirm the diagnosis, see if you can detect a smell of chlorine off the surface of the water, or repeat the DPD no 1 test with only a droplet of pool water in the test tube and watch closely to see if there is a red discoloration before the bleaching occurs.

To Remedy:

- Determine the approximate level of chlorine by diluting the sample of pool water with an equal quantity of natural or distilled water; multiply the answer by 2. If there is still no reading, repeat the process and multiply the answer by 4...and so on.
- If the actual chlorine reading is not too high (i.e. around 10ppm), suspend dosing and allow it to drop over a period of time.
- If the chlorine reading is significantly higher, or if you need to use the pool in the near future, add sodium thiosulphate to reduce the free chlorine. WARNING the recommended dose rate is 0.5kg per 100 cu metres (22,000 galls). Apply this in

several much smaller additions, testing after each dose. An overdose of thiosulphate can leave you with 'negative chlorine' i.e. a chlorine deficit for a considerable time.

**SYMPTOM:** The chlorine level is difficult to maintain. There are three possible causes.

- First possible cause:

In outdoor pools, the hypochlorous acid (free chlorine) is being decomposed by ultra violet from the sun's rays

To Remedy:

- For pools using liquid chlorine (sodium hypochlorite) or calcium hypochlorite, add stabiliser (cyanuric acid) at a rate of 3kg per 100 cu metres (22,000 galls). This should be dosed directly into the pool, NOT pre-mixed with the chlorine.
- Alternatively, switch to a stabilised chlorine - dichlor granules or trichlor tablets

- Second possible cause:

High water temperature. The logic is simple. Bugs are more at home in warm water and breed more quickly. The greater number of bugs will create a higher chlorine demand.

As a rough rule of thumb to bear in mind if there is a heat wave, if the pool water temperature goes above 80 degrees Fahrenheit, the chlorine demand will double for each increment of 10 degrees.

To Remedy:

- The dose rate of chlorine must be increased proportionately. Keep a close check on chlorine levels in hot weather.

- Third possible cause:

Because chlorine levels have not been high enough, there has been a build-up of pollutants, and therefore an increase in chlorine demand.

To Remedy:

- Superchlorinate the pool to around 10ppm free chlorine

## WATER BALANCE PROBLEMS

- Tendency for the pH to remain low
- Tendency for the pH to be permanently high
- pH values are erratic and fluctuate
- pH is locked
- Tendency for the alkalinity to be too low

**SYMPTOM:** Tendency for the pH to remain low (below 7.2).

- Likely cause:

This is usually due either to low pH of mains water (especially in soft water areas) or to the use of acidic chlorine donors, such as trichlor

To Remedy:

- Correct the pH. To raise the pH, add soda ash at a rate of 1kg per 100 cubic metres (22,000 gallons) per day until correct reading is obtained.
- Consider changing to a high pH chlorine source to help achieve a natural balance between the low pH of the water and the high pH of the chlorine donor. Dichlor is roughly pH neutral; calcium hypochlorite and sodium hypochlorite are high pH chlorine donors.

**SYMPTOM:** Tendency for the pH to be permanently high (above 7.6).

- Likely cause:

This is due to either (1) high pH of mains water (especially in hard water areas) or (2) to the use of alkaline chlorine donors such as calcium or sodium hypochlorite, or (3) to hardness salts being leached from new concrete or mosaic pools.

To Remedy:

- The remedy is the same irrespective of which factor is at work here - correct the pH. To lower the pH, add dry acid at a rate of 1kg per 100 cubic metres (22,000 gallons) per day until correct reading is obtained.

- For (1) and (2), consider changing to a low pH chlorine source to help achieve a natural balance between the high pH of the water and the low pH of the chlorine donor. Trichlor is the obvious chlorine donor to choose. For (3), the difficulties with new concrete pools will clear up of their own accord given sufficient time.

SYMPTOM: pH values are erratic and fluctuate.

- Likely cause:

The reason will be that the total alkalinity will be too low to buffer the pH

To Remedy:

- Add sodium bicarbonate to ensure the total alkalinity remains above 100ppm. The dose rate is 3kg per 100 cu metres (22,000 galls) of pool water.

SYMPTOM: pH is locked.

- Likely cause:

The water is over buffered due to high alkalinity. This is a not uncommon problem in hard water areas where the mains feed water has a high total alkalinity.

To Remedy:

- Add dry acid to lower the total alkalinity to below 200ppm. The dose rate is 2kg per 100 cu metres (22,000 galls) of pool water. It is important to add the acid a little at a time and pre-dissolved at a dilution no stronger than 8:1.

SYMPTOM: Tendency for the alkalinity to be too low.

- Likely cause:

The local feed water is low in bicarbonates so that whenever the pool is topped up from the mains, it dilutes the bicarbonates in the pool. This is a particular problem in soft water areas.

To Remedy:

- Add sodium bicarbonate to raise the total alkalinity to around 100ppm. The dose rate is 3kg per 100 cu metres (22,000 galls) of pool water (this should raise the level by 20ppm per dose).

## PROBLEMS WITH POOL SURFACES

- Loss of grouting in mosaic/tiled pools, or sharp edges
- Pool surfaces feel rough and scaly
- Pool surfaces feel slippery
- Tide mark on pool wall at water line

SYMPTOM: Loss of grouting in mosaic/tiled pools, or sharp edges around tiles. There are two possible factors at work here:

- First possible cause:

In soft water areas, the grouting is being etched by the pool water. This is because there is insufficient calcium in the water. There is a tendency for water to form equilibrium by searching for calcium - in this case from the grouting or plaster substrate.

To Remedy:

- Re-grout the pool and increase calcium levels in the water by adding calcium chloride flakes so as to achieve a minimum calcium hardness level of 250ppm. Alternatively, use calcium hypochlorite for shock dosing or for regular sanitisation - calcium will be automatically added to the water in using this sanitiser.

- Second possible cause:

High levels of sulphate in the water. You will need to get your pool centre to test for sulphates to confirm this diagnosis. The sulphate level should not exceed 350ppm.

High sulphates are caused by (a) high sulphates in the mains water (b) the frequent use of dry acid (sodium bisulphate) or (c) use of aluminium *sulphate* as a water clarifier.

To Remedy:

- If you suspect factors (b) or (c), dilute with fresh water and switch to alternative methods of lowering the pH (e.g. using trichlor as the main pool sanitiser), or

clarifying the water (a sulphate-free treatment). There is not much you can do about (a).

**SYMPTOM:** Pool surfaces feel rough and scaly.

- Likely cause:

The balance between pH, total alkalinity and calcium hardness is incorrect, and the water is technically 'scale forming'.

To Remedy:

- Test for pH, total alkalinity and calcium hardness and bring them within recommended parameters. It is best to carry out a 'Langelier' water balance calculation (see water balance), or ask your pool centre to do this for you.

**SYMPTOM:** Pool surfaces feel slippery.

- Likely cause:

This is probably algae forming a colony on the pool surface due to insufficient chlorination at some stage, or to a 'dead spot' in the water circulation.

To Remedy:

- Sweep the affected areas vigorously to remove as much algae as possible, then shock dose with unstabilised chlorine (follow the procedure set out for killing algae). Prevent a recurrence by periodic use of an algaecide

**SYMPTOM:** Tide mark on pool wall at water line.

- Likely cause:

What you are seeing is a build up of greasy deposits such as cosmetics, sun cream or body fats.

To Remedy:

- Clean with a tile and liner cleaner ensuring that it does not contain detergent compounds that could react with chlorine and cause bather discomfort.

## FILTRATION PROBLEMS

- Ineffective filtration in sand filters
- Ineffective filtration in cartridge filters

**SYMPTOM:** Ineffective filtration in sand filters.

- Possible causes:

Either (a) sand has escaped from the filter leaving insufficient filter media to take out suspended particles, or (b) the filter is blocked by accumulated debris or (c) the sand particles are coated in calcium.

To Remedy:

- For (a), it's simply a matter of topping up the sand. If (b), the filter is blocked by debris, backwash. If the problem is persistent, and the sand particles are becoming coated with calcium (more likely in a hard water area), use a filter cleanser.

**SYMPTOM:** Ineffective filtration in cartridge filters.

- Possible causes:

Either the cartridge is in poor condition, allowing particles to pass through it or the demands on it from debris in the water are too great for it to cope.

To Remedy:

- Replacing the cartridge is the obvious remedy. If the problem is persistent, try using a filter aid or water clarifier. Failing this, the ultimate remedy is to install a sand filter.