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Technical Guide - Chemical Balance of Swimming Pool Water

Chemical equilibrium is not just a list of numerical targets; it is a state of harmony where the elements do not attempt to destroy each other. When water is out of balance, it becomes chemically "hungry" or "saturated."

Here's a more in-depth look at why this balance is at the heart of maintenance:

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1. The Efficiency of Chlorine (The Saturation Index)

Many people believe that if water contains chlorine, it is clean. This is a common misconception. The effectiveness of chlorine depends entirely on the pH.

- **At a pH of 7.2:** Approximately 65% of the chlorine is active and killing germs.
- **At a pH of 8.5:** Only 10% of the chlorine is able to work. The rest remains "dormant".
- **Conclusion:** You can spend a fortune on chlorine, but if the pH is high, you're throwing money away and leaving your pool unprotected.

2. "Hungry Water" vs. "Fouling Water" "

Water has a natural capacity to carry minerals. Chemical equilibrium seeks the exact point where the water neither wants to gain nor lose minerals.

- **Aggressive Water (Hungry):** When alkalinity or calcium hardness is low, water becomes corrosive. It begins to "eat away" at the grout between tiles and the metal parts of the water heater in an attempt to balance itself.
- **Saturated Water:** When there is an excess of minerals, the water can no longer keep them dissolved. They begin to precipitate, creating a rough "sand" on the walls and clogging the pipes with limescale.

3. Bather Comfort

The human body has a natural pH of around 7.4 (in tears and mucous membranes).

- If the pool water deviates significantly from this value, it can cause eye irritation and excessive dryness of the skin and hair.
- Often, the "burning sensation in the eyes" that people attribute to "excess chlorine" is actually caused by an **unbalanced pH** or the presence of chloramines (used chlorine that needs oxidation).

The Cycle of Chemical Dependency

To visualize how everything is connected, observe this chain reaction.:

1. **Rain or heavy use** alters **alkalinity**.
2. Unstable alkalinity causes the **pH** to drop or rise.
3. A pH outside the normal range inhibits the action of **chlorine**.
4. Inactive chlorine allows **algae** to grow.
5. As the algae die, the **pH** changes again, restarting the cycle of chaos.

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Chlorine in an unbalanced swimming pool

Maintaining an unbalanced pool is like trying to fill a leaky bucket: you continuously waste resources but never achieve your goal. When the chemical balance fails, chlorine—the most expensive maintenance item—becomes ineffective, generating enormous financial waste.

Here's the real impact on your wallet and the product's effectiveness:

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1. Waste due to High pH

When chlorine enters water, it splits into two forms: **Hypochlorous Acid (HOCl)**, which is the "killer chlorine" (fast and effective), and **Hypochlorite Ion (OCl^-)**, which is very slow and inefficient. The pH determines how much of each will be present.

- **At pH 7.2:** Approximately **65% to 70%** of the chlorine is in its active form (HOCl). You get almost all the benefit you pay for.
- **At pH 8.0:** Only **20% to 25%** of the chlorine is active.
- **At pH 8.5:** Less than **10%** of the chlorine is effective.

The impact on cost: If you add 1kg of chlorine to a pool with a pH of 8.5, it's as if you were only adding 100g and discarding the rest. You will need to buy **10 times more product** to achieve the same result as a balanced pool.

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2. The Sun as a "Thief" of Money

If the water doesn't have the correct level of **cyanuric acid (stabilizer)**, the sun is its biggest enemy.

- Without a stabilizer, UV rays destroy **90% of free chlorine** in just 2 hours.
- This forces the owner to replenish the chlorine daily, often in massive doses, simply because it has chemically "evaporated" under the sun.

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3. The Cost of "Shock Measures "

When a pool becomes unbalanced and chlorine doesn't work, the water turns green (algae) or cloudy (bacteria and minerals). The cost to recover "lost" water is drastically higher than maintenance:

- **Maintenance:** A few grams of chlorine and pH increaser/reducer per week.
- **Recovery:** Requires clarifiers, algaecides, large quantities of chlorine for shock oxidation (superchlorination), and often the disposal of thousands of liters of water during suction to the sewer.

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Comparison of Estimated Expenses

Scenario	Effectiveness of Chlorine	Spending on Products	Water State
Balanced Pool (pH 7,4)	High (approx. 60%)	**1x (Base)**	Crystal Clear and Safe
High pH (> 8,0)	Low (approx. 20%)	**3x a 5x more**	Cloudy and irritating
Without Stabilizer (Sun)	Zeroed out in a few hours	**4x more**	Rapid Algae Risk
Green Water (Recovery)	Blocked	**10x more**	Not suitable for bathing.

Conclusion: Balance is Economy

A balanced swimming pool consumes little chlorine because it remains in the water "monitoring" and eliminating only new dirt that enters, instead of being consumed trying to fight against the water's own chemistry or disappearing with the sun