

# Borates in Swimming Pools

Borates are natural and ubiquitous in the environment. They are mined and refined for a variety of incredibly diverse applications. Their low mammalian toxicity and cost-effectiveness makes them ideal for use in swimming pools.



## Introduction

In swimming pools, borates' greatest asset is their multi-functionality. They are able to:

- Improve swimmer comfort—reducing red eye and skin irritation
- Soften water
- Provide good algal control
- Reduce scaling
- Improve water clarity
- Reduces corrosion
- Save energy
- Be added easily and dissolve instantly
- Improve oxidizer performance and longevity (typically chlorine)
- Provide exceptional buffering capacity

Borates provide both chemical and aesthetic benefits to pools as well as potentially increasing the longevity of pool plaster and other equipment.

Unlike most other water additives, borates are permanent and do not degrade or evaporate from pool water with time. A single dose application will only need very minor top up, perhaps once a year, depending on how much has been removed by rainwater influx or back washing.

Borates are safe and effective; and the newest formulations offer better solubility and pH control.

## The safe, effective, natural additive

As one of Earth's elements, boron is naturally present as a "borate" in rocks, soil, and water. Borates are not synthesized or manufactured like other chemicals—making them a natural additive. Our borates come from one of the largest natural mineral deposits in the world, operated by U.S. Borax in Boron, California.

Borates have a low acute toxicity similar to common table salt. Borates do not bio-accumulate and are not absorbed through intact skin.

## Borates for pool use

Two common issues in swimming pools products—poor solubility and incorrect pH—have been corrected with newer borate technology: Disodium octaborate tetrahydrate (DOT). This form of borate is spray-dried rather than granular. It has a more neutral pH ( $\approx 8.5$ ), so it needs less adjustment to bring the pool pH back in balance. It also has the advantage of carrying significantly more active ingredient than traditional systems (67%  $B_2O_3$  vs only 36%  $B_2O_3$  in borax). DOT is highly soluble and easily added to pool water.

Importantly, the pH of DOT is above the pH 7.4-7.8 typically desired to properly maintain most pools. When used in pools at typical dilution, the new formulation has an ideal pH of  $\approx 7.6$ . Above pH 8, the chlorine becomes much less effective as a sanitizer, but below pH 7.4 the equilibrium trends toward hypochlorous acid and chlorine is lost more rapidly.

In addition to the ideal pH, another benefit of the newer borate formulation is that it's a liquid. A liquid means instant results for the pool tech and homeowner alike—no wait to dissolve the material or to achieve the correct pH. And, no potential for damage if the product is placed directly into a skimmer or drawn directly into an intake. The visual aesthetic benefit is clear water (due to reduction of calcium cloudiness) with more "sparkle."



### What do borates do?

Borates most important role in pool water is to serve as a buffer. The importance of pool pH has already been mentioned, but it cannot be overemphasized. Borates are excellent at holding pH. Maintaining pH is essential to:

- Allow chlorine or other oxidizers to perform as sanitizers and kill bacteria and viruses in the water
- Burn off organic content as CO<sub>2</sub>
- Prevent the growth of algae
- Minimize rapid loss of chlorine
- Slow corrosion and breakdown of pool plaster
- Reduce eye and skin sensitivity
- Reduce scaling and water cloudiness while improving pump efficiency

### Borates and algae growth

Many chemical compounds can perform as buffers, but the two most effective and strongest are phosphates and borates. Phosphates work well, but as an essential nutrient for algal growth, it is not sensible to add it to pool water. Borates can be used as a complete replacement for alkalinity while also preventing algal growth. Borates stop the algal cell from both producing food and then eating it.

### Borates and corrosion

Borates have been used for many years as corrosion inhibitors and are particularly effective on steel and zinc. Borates act as an anode inhibitor, having insufficient oxidizing power of their own, but in the presence of oxygen, they become effective. They have been used successfully in water treatment and in applications such as closed loop cooling systems and in automobile anti-freeze. Borates could be used to reduce the premature failure of equipment (heaters and ladders) in, for example, chlorine generating pools.

### Pool clarity

The presence of cloudiness and scale in pools is a major aesthetic issue. Cloudiness can be caused by a number of factors, only one of which is water hardness caused by high calcium content that can also lead to scale formation. Scale is formed when salts, such as calcium carbonate or calcium sulfate, crystallize from solution on the pool sides.

### Borates help in two ways:

1. They are good buffers, so generally prevent scaling
  2. They lock up calcium almost like a chelate to prevent its formation
- In addition, borates in a pool can give the water a softer feeling, which is gentler on the skin.

All of the various benefits of borates in pool water and new technological advances make borates—specifically DOT—the preferred pool treatment method. With the growing emphasis on the use of natural products, the protection of resources, and the importance of reducing environmental impact, these are the products that customers prefer.

### About U.S. Borax

U.S. Borax, part of Rio Tinto, is a global leader in the supply and science of borates—naturally-occurring minerals containing boron and other elements. We are 1,000 people serving 500 customers with more than 1,700 delivery locations globally. We supply 30% of the world's need for refined borates from our world-class mine in Boron, California, about 100 miles east of Los Angeles. We pioneer the elements of modern living, including:

- **Minerals that make a difference:** Consistent product quality secured by ISO 9000:2001 registration of its integrated quality management systems
- **People who make a difference:** Experts in borate chemistry, technical support, and customer service
- **Solutions that make a difference:** Strategic inventory placement and long-term contracts with shippers to ensure supply reliability

