

Pristiva Information Bulletin
The Pristiva System- Technology Development Overview

I Purpose:

1. To provide technical development background and performance insight surrounding the Pristiva System
2. To support employees, sales partners, applicators and consumers who desire greater technical knowledge of the Pristiva System

This PIB is intended to provide the interested reader with deeper insight into the technology foundation for the Pristiva System while at the same time protecting our intellectual property, pending patents and future product developments. We will attempt to focus on and call out substantiated facts wherever possible and to clearly differentiate fact from theory. It is assumed that the reader will have a reasonable familiarity with fresh water pool treatment chemistry as a basis for gaining the most benefit from this document. This paper is written to provide critical insights put forth in plain English and will avoid highly technical details only fully comprehended by chemists and engineers. Finally, we will not attempt to touch on all findings, but focus only those areas that lead to development of the current products. We have learned much more that will serve as the basis for developing new future products.

II Background:

Pristiva Inc. began assembling a highly qualified, industry experienced, scientific and business development team in 2006, deploying a holistic and environmentally positive approach to an exploratory consideration of the entire salt water pool system and not the individual components independent of one another. We collected and objectively investigated reports of short saltwater chlorine generator (SWG) life, elevated chlorine demand, callbacks on generator performance, higher than expected warranty return rates, scale, corrosion, staining, etching, efflorescence, surface etch, spalling of decks and landscape surfaces and more. Other questions were evaluated such as; when do I add salt to a new pool? Is all salt the same? What is the impact on pool surface curing? What is causing my short cell life? Why do I get so much scale? And the list goes on.

We found the unbiased truth was problems do exist and that industry participants have done their share of finger pointing at each other as the cause of the problem. Pristiva then began scientifically evaluating the pool from new perspectives as a basis for developing products that will improve performance of salt water pools. Research included well over 300 interviews with all channels of the market including; consumers, retailers, service techs, builders, surface applicators, surface manufacturers, salt water chlorine generator (SWG) manufacturers, manufacturer's reps, buying groups, manufacturers of competing and complementary products, NPC, NPIRC and PKData Inc. We attempted to be fair-minded in spending significant time with both detractors and supporters.

III A brief description of the major differences between salt and fresh water pool systems:

Historically fresh water pool chemistry and its relationship to pool equipment has been limited to circulation, filtration, physical cleaning, testing and chemical feeding devices.

Salt water pools add several new variables with, as we will explain, significant implications:

1. The introduction of an electrochemical device known as a saltwater chlorine generator (SWG) to produce chlorine within the recirculation system of the pool.
2. The introduction of ~3200 ppm of salt to the general body of pool water

Figure 1 shows how the salt water pool system works:

(Drawing courtesy of ChlorKing Inc.)

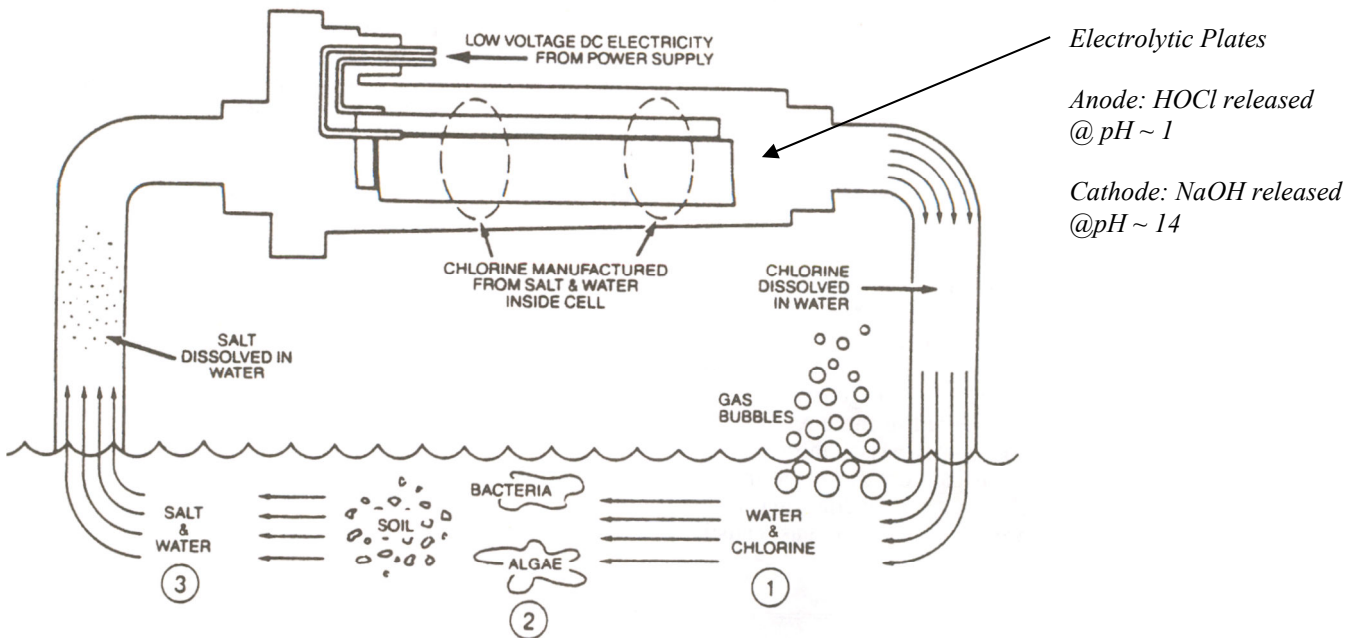


Figure 2 provides the chemical equations and basic translations:

Chemical Equation	What it means
$2 \text{H}_2\text{O} + 2 \text{NaCl (aq)} \xrightarrow{\text{electricity}} \text{Cl}_2 \text{ (g)} + \text{H}_2 \text{ (g)} + 2 \text{NaOH}$	Water plus salt plus electricity makes chlorine gas, hydrogen gas and sodium hydroxide
$\text{Cl}_2 \text{ (g)} + \text{H}_2\text{O} \rightarrow \text{HOCl (aq)} + \text{HCl (aq)}$	Chlorine gas plus water makes the sanitizer hypochlorous acid plus hydrochloric acid

As you will see, these seemingly little differences in the pool system result in a big difference in considerations for preventing problems.

IV Water treatment considerations within SWG's:

Traditionally it has been sufficient for pool water chemistry considerations to be viewed as consistent for all of the water in a pool, that is a parcel of pool water in one part of the pool had the same requirements as in another part of the pool. This worked because the equipment had little impact on the pool water chemistry outside of

maintaining circulation and providing filtration of physical particles in the water. With the addition of the SWG, the facts suggest this is no longer practical or sufficient because:

- a. According to SWG manufacturers, the pH inside the SWG likely approaches 14 at the interface between the pool water and the cathode cell plate and 1 at the interface at the anode cell plate.
- b. According to SWG manufacturers, the chlorine level (as HOCl) inside the SWG likely exceeds 50 ppm at the interface between the pool water and the cell plates within the chlorinator. This is significantly higher than the 1-2 ppm swimming levels or the 10 ppm for shock treatment¹.
- c. The temperature at the water interface with the cells inside an SWG likely exceeds 120°F. There are documented experiences that without water flow the temperature created inside the cell will cause the housing to melt.
- d. Since twice as many basic sodium hydroxide molecules are formed versus one acidic hydrochloric acid molecule, pH continuously increases with salt water chlorination systems. Common pH reducing chemicals that include sulfates actually can contribute to formation of difficult to remove scale therefore many SWG manufacturers advise against using sulfate containing pH reducers.
- e. The plates inside a SWG alternate between a positive and negative charge. Depending on the direction of current flow, one plate is sacrificial and degenerates while the other attracts scale. As the special cell coating is lost on one plate and the oppositely charged plate forms scale, the amount of chlorine produced is reduced and the temperature increases. Depending on water chemistry variables, this has dramatic unfavorable impact on the life of the cell. Left unchecked we have seen salt cells fail within just a few weeks.

Implications: Market research, literature review and scientific analysis of many pool water treatments such as Jack's Magic[®], Natural Chemistry[®], BioGuard[®] Mineral Springs[®] and others strongly suggest that current pool water treatments were not designed with this extreme environment in mind.

- a. Scientific facts confirm that an extremely hostile environment exists inside the SWG, particularly at the boundary interface of the cell and the pool water.
- b. Many pool water chemicals designed to prevent staining, scaling and corrosion are rapidly oxidized to undesirable and essential nutrients for algae (i.e. orthophosphates) and fail to perform as a result of exposure to the hostile environment inside the SWG.
- c. The charged plates within the SWG cell create a unique environment for scale formation and products designed for fresh water pools may cause significant problems.
 - i. Some products marketed for salt water pools such as BioGuard[®] Renewal[®] contain significant levels of sulfates which have been documented to cause extremely problematic scale under certain conditions.
- d. Even easy to remove scale is a problem inside SWG's as it decreases chlorine production. Scale and staining problems are not immediately noticeable and only once thresholds are exceeded do these troubles show up...sometimes long after the source of the problem began.

¹ According to Marty Fisher of Balboa – Ecomatic (at 2007 International Pool and Spa Exposition) representative shocking of the pool is *never* required with a SWG system since the water is "continuously" shocked (20-30 ppm in the electrolytic chlorine generator cell)

V The “purity” myth of pool salt:

Salt is added to fresh water pools at levels of 3,200 to 4,000 ppm. To put this in perspective, an average 22,000 gallon (83,000 litre) in-ground pool will require 533 pounds (242 kg) of salt to achieve 3,200 ppm at start up. That requires over 13 bags of salt weighing 40 pounds (18.1 kg) each be hauled to pool side and distributed over a relatively brief period.

All salt suppliers claim their salt is high purity however the simple fact that adding 533 pounds of anything to a swimming pool doesn't require a significant percentage of impurities present to become meaningful in its impact to pool water chemistry. For example, in reviewing one major salt supplier's advertising (Cargill Diamond Crystal Premium Pool Salt), they claim it is “high purity” and “additive free”. They further claim it is “over 99% pure”. While on the surface this sounds good, it means that Diamond Crystal can physically have up to 1% impurities. This is a small amount when using volumes such as with table salt, but it becomes huge with the quantities that are added to pool water. It is true that Cargill hasn't included any additives, but Mother Nature certainly has.

- At 99 % purity, **5.3 pounds (2.4 kg)** of impurities are introduced to a 22,000 gallon (83,000 litre) pool at start up alone!
- 5.3 pounds or 2.4 kg. of impurities equates to adding ~ **29 ppm** of unknown stuff into the pool
- If only 5% of the impurities were iron, this would equate to ~ 1.5 ppm iron...more than sufficient to cause discolored water and possible staining of pool surfaces
- Even at 99.9 % purity over ½ pound (225 g.) of impurities are added to the pool

So, the nature of these impurities is extremely important. Most pool folks know that if the impurities contain metals like iron, there are potential staining problems. If they contain organic material, they will create a chlorine demand. And if they contain phosphates, they will potentially increase the risk and degree of algae or lead to scale formations.

Accordingly, we understand the importance of identifying the nature of these impurities to determine their potential impact when used in swimming pools. And that is what we set out to do in our effort to source the best salt for pool purposes.

VI Our research first focused on current salt products

We collected 16 individual unopened 40 pound (18.1 kg) bags of pool salt from most geographic production points of currently identified US suppliers: North American Salt, Morton, United, Cargill, Buckman and Salco. Products were sampled in a double blind fashion so that independent analytical laboratories did not know the origin of the product. Independent scientific analysis was conducted by Applied Technical Services, Georgia Institute of Technology and SRC Analytical. While analyzing for the nature of contaminants such as iron, manganese, silicates and organics, we also looked at real world performance considerations in swimming pools such as: rate of dissolution, turbidity over time, turbidity after chlorination, chlorine demand, effect on plaster surfaces, and pH. With well over 1,000 double blind, scientifically generated data points, we have been able to get a fair-minded sense of competing pool salts, gain an understanding of just how comparable they are, and identify any potential contribution to pool problems.

VII Some surprising results

We can summarize our findings by advising that science proves that all pool salt is clearly not the same. Our independently derived data shows that salts contain differing levels of contaminants such as iron, manganese, copper, nitrates, phosphates, silicates, sulfates, high calcium levels and even heavy metals. In addition to these materials, we also found many cases of significant levels of organic contamination that caused chlorine demand and could create problematic conditions in pool water. The nature of contamination varied considerably by geographic region and by the way each salt is produced. As we studied salt processing, we began to understand that contaminants can be present and attached to the lattice structure of the crystal itself, locked into internal spaces between the crystals or reside on the surface. Experts in salt production informed us that “the impurities cannot be totally removed for pool grade salt no matter how much washing occurs as part of the process”.

Next we focused on a blind ranking of the salts based on problems they might contribute to a pool. We found that all the “solar salt” (salt that is produced from the evaporative action of the sun and wind on sea water and left to naturally concentrate in ponds) created significant issues of chlorine demand and unacceptable levels of water cloudiness (turbidity) over time. Not content to just accept this observation, we sought the underlying cause and were surprised at the findings. You see, all solar salt comes from evaporating ponds that are wild life sanctuaries and habitat for many species of birds, ducks, fish and shellfish. As the salt concentrates, the shellfish die and are replaced by bacteria that are particularly adapted to the salt and give off beta-carotene...all of which remain at some level in the salt as contaminants. So in adding 533 pounds (242 kg) of solar salt to a swimming pool, up to 5.3 pounds (2.4 kg) of animal waste and dead bacteria are also included...not something we should knowingly add to a swimming pool.

Based on this information, Pristiva recommends that solar salt is not used in swimming pools!

As we eliminated solar salt and began looking more closely at mined salt, we found that while the organic contamination was mostly eliminated, other undesirable inorganic contaminants such as manganese, copper, nitrates, phosphates, silicates, sulfates, high calcium levels and heavy metals were present in varying degrees. They affect water clarity, dissolution rate, stain and scale potential and other key water balance factors. As we continued to rank the remaining salt samples we found that one unique source of salt from Amherst, Nova Scotia was far superior in virtually every respect to all other salt sources tested from North America and the Caribbean.

Again, not satisfied with just the observation of the Nova Scotia salt performance, we sought geological confirmation of its uniqueness and found that Nova Scotia salt has a distinctive geological evolution starting about 350 million years ago. More specifically, a huge basin, now called the Avalon Terrane, filled with sea water about 340 million years ago. Repeated flooding and drying over the next 15 million years had the effect of eliminating some of the undesirable deposits that would have been produced with other mined salts.

So, we determined from our scientific efforts exactly where to start with developing Pristiva. It had to be based on Nova Scotia salt... the best salt to use for swimming pools...but that was only the beginning.

VIII Product development:

Our scientific understanding of the factors making up the hostile environment inside the SWG lead us to utilize ingredients that in many cases are not used today in swimming pool products. Our team drew on its experience in industrial water treatment in areas such as the thermal desalination of sea water to make fresh water, high pressure oil field water treatment, extreme temperature boiler water management, high evaporation arid climate soil management and recirculating cooling water systems where many aggressive environments exist for creating scale, corrosion and surface degradation. We looked at new techniques in crystal modification and delayed precipitation as well as scale removal and metal chelation. All ingredients were carefully reviewed for their safe use in swimming pool water and in many cases are based on other minerals and food grade ratable compounds. Finally we provided additional benefits to swimmers with improved water comfort and quality. Our scientific experimentation and product development ultimately lead us to deliver the following:

- A salt crystalline structure that dissolves up to 4 times faster than many pool salts making it the fastest and easiest to apply with the least amount of brushing required
- A salt that is the best for use in swimming pools based on minimization of contaminants
- Extended protection against the all important problem of scaling within the chlorine generator which is the leading cause of cell failure and low chlorine output
- Extended protection against staining with multiple mechanisms and components for preventing metallic stains
- Superior performance against certain types of corrosion and pool finish pitting
- Elimination of the use of phosphates and sulfates that can cause problems with SWG performance
- Improved swimmer comfort with water that feels silkier and softer than ordinary salt pools
- Ingredients that are stable in the hostile environment inside an SWG
- A system we believe is better than anything else on the market and will protect the economic investment of all parties

We have not attempted to cover all details and aspects of our technology and more information will be forthcoming as our patent protection is received.

IX The Pristiva System:

With a goal to achieve a holistic, simple and flexible approach, our new technology scientifically provides a more complete solution to salt water pool care than currently exists. Maintaining a flexible delivery program was also deemed a priority. The key consideration is that today, the salt component is not generally added as the pool is filled and in fact there are many different regimens and theories of exactly when salt should be added. While that is something we are currently working on, it is generally agreed that salt should not be added to swimming pool water for a minimum 30 days after filling. As a result, we decided to provide a 3 component system that allows for adding the products in a flexible manner. This flexibility is maintained whether the pool is new or a retrofit with previously balanced water.

Pristiva Primer® is added as soon as the pool is filled and provides immediate protection of pool surfaces while waiting until the salt is ready to be applied. At that time, Pristiva Premium Salt is added as needed and the SWG is started up 24 hours later. The third product in the system, Pristiva Premium Shock, is added immediately after



the Pristiva Primer application and provides initial benefit in kick-starting the system. As simple as 1-2-3 for the customer.

X Only the beginning:

Our research indicates this is only the beginning of our new product development activity. We do not suggest we have addressed every area and are excited as we look forward to our next round of scientific exploration. Please feel free to contact us and advise of any suggestions based on your current problems and needs. Our desire is to be responsive to our customers with products that add value for everyone.

For more information about Pristiva Products, go to www.pristiva.net to locate your manufacture representative.