Ever since 1854 when John Snow successfully chlorinated part of London’s water supply to save its citizens from a deadly cholera epidemic, chlorine has been seen as the most trusted way to sanitise water.

That applies equally to swimming pool water as to drinking water, because if it isn’t safe to drink, it isn’t fit to swim in either.

But while chlorine has been long seen as the single most effective way to make water safe, it does have drawbacks: sometimes related to incorrect dosing, sometimes to poor storage and handling. The main considerations are to do with chloramine production and its effect on people sensitive to eczema and asthma, as well as other more serious disinfection by-products which may occur in high bather load public pools, especially if indoor.

However, properly administered and handled, chlorine remains far and away the most popular chemical for disinfecting pool water.

In fact, the most popular mode of residential pool sanitisation in Australia – salt chlorination – is actually using chlorine.

The chlorine is created using a process called electrolysis – by which the water passes over an electrolytic cell, splitting the sodium chloride compound to create chlorine: generally hypochlorous acid (HClO) and sodium hypochlorite (NaClO).

Using salt to generate the chlorine has a number of advantages, in particular the fact that you don’t need to store the chlorine. There are also some disadvantages, such as an increased need to protect against rust and efflorescence.

Recently, there has been a move to use other mineral compounds apart from sodium chloride – particularly magnesium chloride and potassium chloride – to generate the chlorine.

There is also a way to create chlorine by electrolysis without adding anything, simply using the existing compounds found in everyday water.

Finally, there are methods both new and old that do not use chlorine at all. Some use hydrogen peroxide, others ozone, ionisation and even ultrasonics.

Many of these methods will be discussed further in the article, but while we aim to be comprehensive, we can’t cover every single device or proprietary method.

It is worth considering Australian ingenuity when reading through this article, as it is the commercial application of innovate local ideas that is driving this market segment.

Residual

One of the issues with using alternative sanitisation methods is the question of “residual”.

The water in a residential swimming pool must be “turned over” through the filtration system (usually every eight hours for a residential pool) to ensure all the water in the pool has been treated in a timely fashion.

But as well as treating water that is drawn from the pool into the filtration loop, there should be some disinfectant in the pool water at all times. This is called the “residual”, and is intended to protect swimmers from pathogens that have been introduced.
into the water after it is returned to the pool. These pathogens could potentially come from a number of sources, most notably “cross-infection” from another bather.

However, some alternative systems only treat the water in the filtration loop (or another, separate loop) and don’t leave a residual of disinfectant in the pool itself. These systems include ozone and ultraviolet light (UV).

Therefore, they are usually combined with another system that does leave a residual – most commonly chlorine.

Public pools are required to have a residual and one of the most active state departments, NSW Health, has recently published a Public Swimming Pool and Spa Advisory Document that explains this in much more detail. It is available at splashmagazine.com.au under the QuickLinks tab.

According to Australian standards, residential swimming pools must have a disinfectant with a 1ppm residual from one of the chemicals prescribed by the Australian Pesticides and Veterinary Medicines Authority (APVMA). However, it should be noted the APVMA only has authority to approve chemicals, not other non-chemical processes such as UV.

**MagnaPool**
The first of the popular mineral pool systems, MagnaPool, was somewhat of a breakthrough in 2009 when introduced by Poolrite. It was a different way of creating chlorine for swimming pools, using electrolysis to convert a number of minerals, most notably magnesium chloride and potassium chloride, to make the chlorine.

Importantly, it was also a different way to market swimming pools – almost like a health spa in your backyard. The water and the marketing proved popular with end users, and there was much anecdotal evidence of the swimmers being particularly happy with the feel of
the water. However, supply of spare parts became a problem as well as the cost of the minerals under the Poolrite model.

It started the trend of new pool mineral packages including Astral-Pool’s Aqua Therape, AIS’s MineralChlor, BioGuard’s SoftSwim conditioning system and the latest system, International Quadratics Therachlor which is discussed in more detail on page 88.

In August 2013, the Poolrite business was finally sold to Evolve, with Zodiac Australia gaining the MagnaPool system. Zodiac rejigged the system and officially relaunched it this year.

Jonathan Bristow is category manager for water care appliances, automation and heating products at Zodiac Group Australia, covering responsibility for the MagnaPool brand.

He says that MagnaPool is not just a form of sanitation: it is an entire system that must be installed with all its various components in order for it to work the way it was intended.

“The system comprises at its core three things: the hydroxinator, the minerals and the glass media, each one of these plays an equal part in what makes up MagnaPool,” he says.

Hydroxinator is the term used for MagnaPool’s chlorinator, which uses the principle of electrolysis to generate the sanitiser (hypochlorous acid) by “cracking off” the chloride molecule attached to the magnesium chloride and potassium chloride minerals.

“The word hydroxinator comes from the fact that it also produces magnesium hydroxide, also known as milk of magnesia,” says Bristow.

“Our system uses no sodium at all, which reduces the environmental impact often associated with high salinity backwashing. In fact, we recommend that you dilute the backwash from MagnaPool and use it as a fertiliser spray for your backyard. The magnesium and potassium are well known and well used fertilisers in the horticulture industries.”

Bristow says that magnesium also behaves as a strong flocculent, which is the reason for using glass media in the filter.

“Studies have shown that sand media is generally inefficient with magnesium because of the floc effect, and will tend to ‘clog’ the filter, as it will with a cartridge,” he says.

“Glass on the other hand works perfectly, providing crystal clear water when using a combination of coarse glass (in the bottom to cover the laterals) then topped up with fine glass.”

He also says that swimmers feel better swimming in the MagnaPool water.

“As far as ‘health’ benefits, we do know this: that people with skin conditions that are generally exacerbated by swimming in traditional pools (salt or liquid...
BioGuard’s SoftSwim first converts the pool with a low volume of minerals and is then used once per week to condition the water for swimming chlorine, say their conditions are reduced in a MagnaPool. We have testimonials from many users saying that MagnaPool helped calm their condition and allowed them to enjoy swimming in the pool. Many swim schools are using MagnaPool because it allows the instructors to remain in the water and the water isn’t as harsh on the skin.

He also says there seems to be a relationship with absorption of magnesium through the skin when swimming in a MagnaPool, and that Zodiac is conducting tests to determine the absolute level at which this happens.

Brand’s new life
Since acquiring the brand, Bristow has had to deal with some of the issues left over from the Poolrite era including pricing. Also, during the latter days of the Poolrite saga, the MagnaPool brand was caught up in the ill-feeling between some of the participants.

“The brand suffered a bit of negative press,” he says. “Particularly in the trade as the commercial pricing structure that Poolrite had offered was way off the mark. There was and still is quite a bit of negative comment on the web by some disgruntled ex-employees that targeted Ross Palmer directly and the ‘smear campaign’ of trying to tear apart all claims made by MagnaPool. Unfortunately we have inherited this as much of it still exists on the web. We hope that as time goes by, the brand’s efficacy will stand on its own merits and people will see past what was clearly a personal attack against Ross rather than an open discussion about the product’s capabilities.

“We haven’t altered the system that Poolrite finally used, we have only increased the mineral levels to ensure sufficient sanitizer production with our own model hydroxinator, as some users reported the old Poolrite version couldn’t keep up production in some of the hotter climates,” he says.

“And we have rebranded the product now also, to make a clear distinction between the previous MagnaPool and the newly upgraded Zodiac version. We feel the marketing materials and direction breathes some new life into the brand and brings it up-to-date.”

How electrolysis works
Australian Innovative System (AIS) Elena Gosse explains the inner workings of electrolysis:

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"Inside an electrolytic cell an electrical current is passed between two electrodes (an anode and a cathode) through an electrolyte (that is, water containing minerals like sodium chloride). Hydrogen ions move to the cathode and turn into hydrogen. Chloride ions move to the anode and turn into chlorine. Meanwhile, sodium and hydroxide ions get left behind and stay in the solution. This provides all the necessary ingredients for the automatic formation of hypocholous acid, an effective and proven water sanitiser," she says.

Gosse says that one of the extra benefits of electrolysis can be a reduction in chloramines.

“When people enter swimming pools, amines enter with them. Amines are found in perspiration and urine. If the level of free chlorine in a pool is low (relative to the amount of amines), chloramines may form. In non-AIS ‘traditional’ chlorine injection systems, chloramines may linger in and around the pool until the system is shock-dosed – which can only be done when the pool is empty for a long period such as overnight,” she says.

“Shock dosing on this scale consumes a lot of chemicals and may contribute to rising TDS levels, requiring the addition of fresh water to dilute it.”

Gosse says that with inline chlorination by electrolysis, the concentration of chlorine within the electrolytic cell has the effect of virtually shock-dosing the water every time it passes through the cell – which is multiple times each day – in the process, oxidising chloramines.
“This may explain why indoor pool operators who switch from traditional chlorine dosing to inline chlorination by electrolysis report a noticeable improvement in indoor air quality,” she says.

EcoLine

In 2009, AIS launched EcoLine which was a totally new concept for swimming pools disinfection.

The system basically uses electrolysis to generate chlorine, but without the need for adding salt or other types of chloride to start the process.

It is an on-site inline chlorine generation plant capable of producing chlorine in fresh water from the small amount of natural salts and minerals already present in the standard water supply.

“It can operate at total dissolved solids (TDS) levels 75 per cent lower than the 5000ppm typical of salt water chlorinators like AutoChlor, and can in fact operate as low as 1200ppm,” says Gosse.

“This is typically referred to as ‘fresh water’,” she says. “Fresh water inline chlorination remains a revolution for the water industry.”

The benefits of this are clear. First, you don’t need to buy bulk chlorine or even salt. This not only saves recurring expenses, but reduces occupational health and safety risks inherent in the transport, handling and storage of chlorine. In a more general sense, its widespread use would reduce the amount of hazardous chemicals being transported on public roads and highways.

“Also, it shock doses the water every time it passes through the cell, oxidising chloramines along the way. And as it’s a largely automated process, it reduces operator input and maintenance.”

The product was a finalist in International Stevie Award for the Best Innovative Product of the Year in 2009, and won the Most Environment-Friendly Sanitisation Product Award at the 2010 SPLASH! Environmental Awards.

All production is developed and manufactured in Australia.

PoolRanger recently installed a system on a trial basis at Warringah Aquatic Centre, and the results have come back very favourably. There is more on this story in the commercial news section on page 64.

Hydroxypure

The most recent addition to the alternative sanitisation world is Waterco’s Hydroxypure. It was launched at SPLASH! Asia in 2013 and earlier this year was approved for use by the City of Gold Coast Council for their commercial swimming pools.

The concept was developed by inventor Nick Briscoe because his son’s eczema, which had been badly exacerbated by contact with chlorinated water. He tested all the existing technologies and, after seven years, eventually settled on a combination of hydrogen peroxide and ozone.
If you are cleaning test tubes, crushing tablets or waiting for reagents to react then the answer is probably yes. That’s the old way of doing things. The new way is LaMotte’s WaterLink Spin: A game-changing photometer that takes little effort and just 60 seconds to accurately and comprehensively analyse a water sample and produce a treatment report.

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The Warringah Aquatic Centre manager Gary Penfold recently praised Ecoline following a trial of the system. There is more on this on page 64.

“I tried ozone, but it’s hard to mix the ozone in the water,” he says. “In the end I used a UV ozone system and we created ozone and hydroxyl radicals. Hydroxyl radicals are non-selective: they’ll kill everything. If you add hydrogen peroxide to water with ozone in it you get the peroxone process. This makes it 20 to 50 times more effective in killing pathogens.”

The ozone doesn’t enter the pool water, but is used up in the MultiCyclone, where the advanced oxidation process occurs. The residual is a special stabilised formulation of hydrogen peroxide.

Briscoe says they can run at much higher calcium hardness levels in the water because there’s no scaling.

“That means the water is much more pleasant to swim in.”

Chlorine can aggravate asthma as well as eczema in sensitive people, and Hydroxypure is the only swimming pool sanitisation system with the Sensitive Choice mark from the National Asthma Council Australia. This mark is awarded after a formal review process including the expert inspection of independent scientific research to ensure the product offers a better choice for asthma or allergy sufferers.

Marketing director Bryan Goh says that while Waterco was not the first to introduce a chlorine-free pool or swim-spa, they are the first to have a fully automated chlorine-free system.

Goh says Poppits, which Waterco has recently purchased, had a range of chlorine-free products including Sanoil (which also contains silver), that was used for spas and swim-spas. However, it was manually dosed.

“So we’ve taken what Poppits did in smaller bodies of water like spas, and brought it to bigger bodies of water such as swimming pools that have many more variables to contend with.”

He says the key to the system’s efficiency is its automated process.

“Public pool sanitation systems must be automated according to NSW Health – they must be able to meet demand, and to adjust to respond to meet bather load according to requirements,” he says.

Goh says Waterco was fortunate with approvals, as hydrogen peroxide – the active ingredient in Hydroxypure – is already approved by the APVMA.

“You have to have one of the approved residuals and we do. Hydrogen peroxide is approved at 100ppm for residential pools and 150ppm for commercial pools”.

He says hydrogen peroxide is a safe swimming pool sanitiser.

“It is used at three per cent in food industry and we are using just 0.1 percent in solution, so it’s 30 times less than used in food industry for cleansing fruit, and at that concentration it’s definitely safe”

Some in the industry had questioned how long the hydrogen peroxide would remain active in the pool water, but Goh explains that Hydroxypure uses a specially formulated, stabilised blend of hydrogen
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“If you get commercial approval you cover everything because it’s so much more stringent than residential, that’s why Turtle Beach was so important to us,” says Goh.

“We have a letter from the Gold Coast City Council advising that the Council’s Health, Regulatory and Lifeguard Services Branch has approved the continued use and the extension of use of Waterco’s Hydroxypure Water Treatment System in the swimming pools, spas and proposed water theme park within the Turtle Beach Resort.”

Nick Briscoe explains how approval by the City of Gold Coast Council is paving the way for the system’s more widespread acceptance in other states.

“In Queensland it’s a little different than the rest of Australia. Queensland Health does not have any legislative base to approve, endorse or assess any disinfection processes. They leave it up to the councils or regional areas to decide what disinfection system to use, as long as it meets the regulations and abides by the APVMA’s requirements and bacterial count requirements. Those requirements are the same for Queensland as for the other states,” says Briscoe.

“After a period of consultation with the City of Gold Coast Council on the mechanics of how the Hydroxypure system works, an agreement was reached for a trial to be conducted under strict operational conditions.

Peroxide which lasts longer in the pool than standard hydrogen peroxide and also has a longer shelf life.

“Also, hydrogen peroxide is not affected by temperature – which is why Poppits used it in spas.”

**Turtle Beach**

So far, the most exciting installation of the system for Waterco is the Turtle Beach Resort on the Gold Coast.

Nick Briscoe launching the Hydroxypure system at SPLASH! Asia

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Enviroswin

Gary Stutt, co-founder and executive director of Enviroswin, started using a copper and silver ioniser when he lived in Manilla, after an earthquake disrupted the city and made getting a regular supply of chlorine impossible.

Impressed by its effectiveness, he set up Watertech Services International in 2000 with co-founder and director Phil Jones to produce and market ionisers in Australia and other markets.

The system has undergone a number of transformations since then, and Stutt and Jones are keen to demonstrate their latest version, the ES3, is not just
another ioniser but is a proven hybrid system with “more credentials than any other sanitiser”.

At the heart of their claims is the extensive research undertaken by the highly respected US organisation, the National Sanitation Foundation (NSF), which tested the Enviroswim system for 7000 hours, gaining them the NSF 50 certification which includes it passing tests for microbiological efficacy, uniformity of output and safety against staining pool surfaces (after NSF ran it on a white plaster finish) amongst other things.

The original Enviroswim ES1 unit ran alongside chlorine. It met the stringent NSW Health protocols in tests conducted by the government-run Tweed Laboratories in Tweed Heads.

“Dr Paul Wright conducted the tests and the ES1 unit sailed through,” says Stutt. “The CT (control time) was a 4-log reduction of Pseudomonas aeruginosa within 30 seconds.

“Then in 2002 we were contacted by Chandler Aquatic Centre and put the ES1 system with chlorine in the indoor pool. It was there for about five years.

“The venues could reduce the level of chlorine volume required but maintain the level of free chlorine because of the reduced demand. We reduced chlorine consumption considerably. And you didn’t have the oppressive chloramine smell because the less chlorine you use, the less chloramines you produce,” he says.
“At the time, Brisbane city councils had had problems with crypto,” says Jones. “But while we were there, we never had an issue with crypto. The system was the ES1 plus chlorine. It was being independently tested by Brisbane Water and in all that time we had not one failure on plate counts. And it was a community pool used by a lot of disabled groups. Previously, the chloramine issue had been so bad the staff wanted desk jobs.

“As soon as we put the equipment in, they never had another issue of crypto and the chloramines disappeared.”

Stutt says that at the time there was a major drought and they were asked to see if they could reduce the TDS in the community pool without dilution, as the levels had been rising and they were getting dermatological problems.

“During trials we discovered at low TDS levels we could produce ORP (oxidation reduction potential), so we applied for a patent incorporating ultrasonics, ionisation and electronic oxidation. That’s the heart of the patent that’s been granted all over the world,” says Jones.

The latest version of Enviroswim is called the ES3. It produces oxidants including chlorine at low TDS levels and Jones says that Enviroswim’s residual sanitiser is measurable at the poolside using a copper test kit, ORP and/or diethyl-p-phenylenediamine (DPD) test methods. The two latter methods measure chlorine and other oxidant residual levels.

“Enviroswim’s high sanitising efficacy is due to the use of a combination of multiple sanitising agents combined with ultrasonics,” he says.

“The ultrasonics-induced cavitations cause extremely high local pressures and temperatures without increasing the ambient level. These local effects result in the breakdown of suspended solids and increase the efficacy of the disinfectant using
Enviroswim’s patented three-process methodology, combining electronic oxidation, ultrasonics and copper/silver ionisation.

“Enviroswim has a residual that lasts several months,” says Stutt. “Copper and silver in water has an excellent residual because it doesn’t evaporate, it’s not volatile like chemicals. Part of our residual will work 24 hours a day whether the pump is on or not.

“The system generates some chlorine through an electrolysis process via a cell but the main disinfection efficacy is created by a combination of processes. Copper and silver break down the cell walls and so help to disinfect the pool,” he says.

“There are two systems of disinfection. You can have burning or poisoning. Copper and silver poison by attacking the DNA; chlorine burns by oxidation. In Enviroswim we have both the oxidation, and copper as an algaeicide and silver as a bactericide.

“Additionally we have the ultrasonics that prohibits scale and also giardia and crypto. Although not scientifically proven, we believe it takes away the ability of the parasite to use calcium and silica in the water to produce a shell. The ultrasonics converts calcium and silica from a snowflake crystal to a long thin brittle aragonite crystal. So it’s difficult to scale, and difficult for parasites to use for its shell, so you don’t have the proliferation of the parasites in an Enviroswim pool.”

Stutt says that after Enviroswim was installed in the Chandler Aquatic Centre, council officials asked what they were doing differently, because over two years they’d had no instances of giardia or crypto.
Council asked them to look at their more problematic pools, to see if they could fix them as well. Jones says they were offered a bursary from the council to carry out more efficacy testing, specifically against giardia and crypto, but were unable to find a laboratory in Australia that was prepared to carry out the work.

“We have NATA-accredited labs backing us up, and believe we’re the only Australian company with the NSF 50 accreditation. It’s one of the hardest to get. We have the system on the luxurious World Cruise Ship – the largest privately owned cruise ship in the world. We’ve had ES3 in their pools for four years. It’s also in the pools at Hugh Jackman’s Gwinganna resort and health spa in the Gold Coast Hinterland, and the Eco Village in Currimbim, voted the most sustainable development in the world, as well as the Banyan Tree Resorts in Mauritius.

“In all, we have 4000 units in Australia, Europe, Asia and the US.”

Enviroswim is 100 per cent made and designed in Australia and is patented all over the world.

AquaSpa

Lo-Chlor chemicals has released a new chlorine-free and bromine-free spa sanitisation system called AquaSpa, as well as a chlorine-free and bromine-free pool sanitisation system called AquaFresh.

Managing director Paul Simons says Lo-Chlor Chemicals realised the necessity and demand for a product that would both safely and easily sanitise spas, they spent the best part of a decade researching and developing the new system.

The system is based on PHMB, better known as biguanide or polyhexanide, which has been successfully used in disinfection in a wide variety of industries including the swimming pool industry in the United States.

“The technology behind AquaSpa is a revolutionary combination of three products,” Simons says. “The base of which is PHMB as the sanitiser component.”

He says products containing PHMB are used for disinfection in operating theatres and hospitals for surgical and non-surgical wound dressings, hydrotherapy, and burn wound management amongst many other uses.

He says the sanitiser component is extremely gentle on skin, hair and clothing, as well as having no harsh side effects on either the spa or equipment. It is specially formulated to control the growth of bacteria and disease.

“AquaSpa has been fully registered as a recognised sanitiser for spas with the APVMA and is one of the fastest growing ranges in the spa market today,” he says. The sanitiser is also registered for swimming pools.

Simons says the weekly three-step dosing procedure makes it both easy and economical to administer.

Bio pool cleaner

Considering the upsurge in alternative sanitisation methods – especially bio or natural pools – Maytronics has developed a robotic pool cleaner specifically for these new types of swimming pools.

The Bio Dolphin pool cleaner is targeted for bio pools, alternative sanitation pools and other types of pools where the debris load may potentially be high.

The Bio Dolphin features systematic scanning technology, PVC brushes for rugged application, a swivel and advanced scanning algorithms.

In particular, it features a secondary waste removal line – to remove debris to a separate waste storage system.

“As end users look for different ways to sanitise their pools, this creates the need for alternate methods to clean them,” says Dan Kwaczynski, managing director of Maytronics Australia. “The Bio was created specifically for this niche market.”

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