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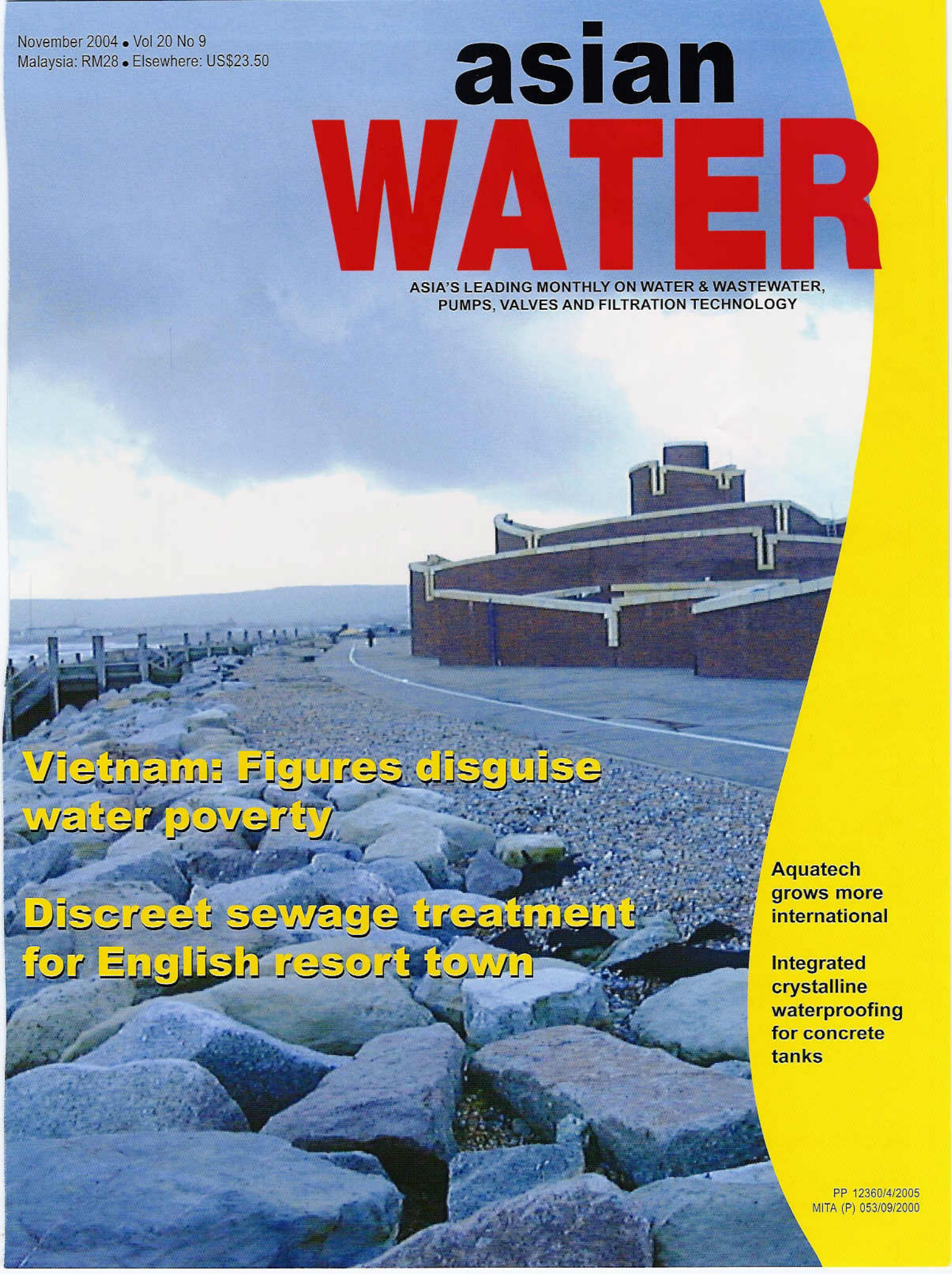

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Integrated crystalline waterproofing for concrete tanks

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Integral crystalline waterproofing for concrete tanks

Used for more than 30 years worldwide, Integral Crystalline Waterproofing (ICW) is an innovative technology that uses a chemical reaction to turn concrete into a permanent waterproof barrier. Read on to find out how ICW offers a superior waterproofing and self-sealing properties.

Leo Connell

The Seletar Water Reclamation plant is part of a network of Singapore water treatment plants. These facilities are key components in Singapore's plan to become self-sufficient in water production and reduce the amount of water it imports.

Nearly 250,000 m^3 of wastewater from Singapore's sewers is processed daily through the plant, which uses reverse osmosis technology to produce water that can be used by industry in place of valuable potable water. Water generated at the Seletar plant is added to Singapore's sewers, where, once processed through conventional water treatment facilities, it can be used as drinking water.

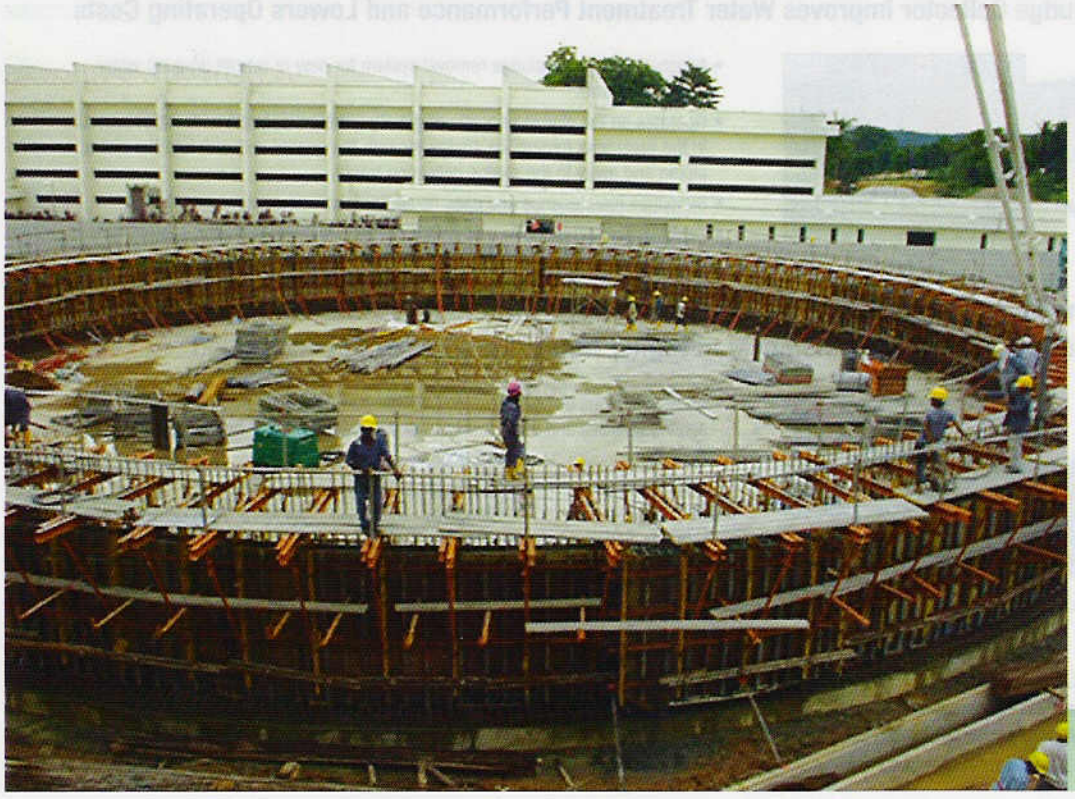
Recently, the Seletar Water Reclamation facility added a new post-tension water tank and needed to select an appropriate waterproofing system for the structure. In post-tension construction, steel strands are threaded through plastic tubing that runs in both directions through a concrete slab. The steel strands are then tensioned at either end of the concrete, enabling it to bear more weight, and reducing cracking. While post-tension construction offers a number of benefits, it requires reliable waterproofing protection to safeguard the steel cables from corrosion and deterioration.

In addition to providing superior corrosion protection, the waterproofing system selected for the Seletar project needed to meet several other key criteria. It needed to provide for quick and efficient installation, in order to meet the 30-hour timeline provided for the tank to be poured and set. And, since the recycled water stored in the new structure would potentially enter the country's water supply, the waterproofing system needed to be guaranteed non-toxic.

With a wide range of waterproofing systems available on the market today, the project team had many choices, including:

- Self-adhering, rubberised asphalt sheet membranes or barriers.
- Liquid membranes that are applied by spray, roller or trowel.
- Cementitious products that are mixed with water and brush-applied.
- Built up systems, where layers of hot asphalt are alternated with perforated felt layers to form a physical barrier.
- Sodium bentonite, a clay material that is applied in panels to the outside of a structure and works by absorbing water and swelling to fill the cracks and voids in concrete.
- Integral crystalline waterproofing (ICW) systems, which create a chemical reaction within concrete that causes crystals to form and grow, filling the spaces between concrete particles and permanently blocking water.

After weighing the various options, the Seletar plant team selected an integral crystalline waterproofing system because it offered a number of key advantages over the other alternatives.



Seletar Water Reclamation Plant under construction.

What is Integral Crystalline Waterproofing (ICW)?

Used for more than 30 years worldwide, ICW is an innovative technology that uses a chemical reaction to turn concrete into a permanent waterproof barrier. Along with blocking the migration of water through concrete, ICW is also known for its ability to react with the presence of incoming water to self-seal cracks that inevitably develop in concrete, providing long-lasting protection against water and waterborne contaminants.

How does ICW work?

When added or applied to concrete, integral concrete waterproofing technology creates a chemical reaction that causes needle-like crystals to form, filling pores, capillaries and hairline cracks in concrete. By blocking these concrete passageways, ICW crystals permanently prevent the movement of water in all directions.

As long as moisture remains present, ICW crystals continue to grow throughout the concrete, reaching lengths of many inches over time. Once the concrete has dried, the crystalline technology sits dormant until the next dose of water causes the chemical reaction to begin again.

This ability to remain dormant and reactivate in the presence of water gives ICW-treated concrete the ability to "self-seal". When cracks form, water entering through them reacts with the dormant ICW chemicals causing new crystals to form and grow, blocking and filling the cracks and stopping the migration of water. ICW's ability to self-seal cracks can help to dramatically reduce long-term maintenance and repair costs.

Benefits of Using ICW

Along with superior waterproofing and self-sealing properties, ICW offers a number of key benefits:

- Incorporating ICW products at the planning stage eliminates many of the challenges associated with blind wall applications. There is no need to leave room outside the structure for membrane application. Project teams can design a larger structural footprint, build right to the property line and begin backfilling as soon as the concrete is set.
- Because ICW is added right to the concrete mix, there is no need for any kind of surface application. The cost of the ICW admixture is more than offset by the cost savings realised by eliminating the time and labour required to apply external membrane systems.
- Integral crystalline waterproofing improves concrete's workability and pumpability during construction, reducing large air pockets that weaken concrete. By reducing premature moisture loss, ICW helps to strengthen concrete and reduce shrinkage and cracking during the curing process.
- Unlike external waterproofing membranes, ICW is guaranteed to last the lifetime of the structure. Where membranes can be scraped, punctured or torn, ICW is impervious to physical damage. Even years later, ICW crystals remain, blocking water and self-sealing cracks.

In hot or tropical climates, integral crystalline waterproofing offers

several key advantages. In hot weather, concrete's setting time can be dramatically shortened, resulting in weaker concrete and enhancing the likelihood of shrinkage and cracking. ICW cools concrete and reduces premature moisture loss, creating a more durable structure and reducing shrinkage and cracking. Unlike membrane systems that can become brittle and deteriorate when exposed to prolonged heat, ICW is unaffected by climate and remains effective for the life of the structure.

The soil in many hot or tropical climates can contain high levels of sulphates, chlorides and other chemicals that decrease concrete's integrity and corrode steel reinforcements. By blocking the penetration of water that can carry these contaminants and safeguarding concrete and reinforcements against corrosion, ICW can help to prolong a structure's useful life.

How is ICW Applied?

Integral crystalline waterproofing products are usually supplied as a dry powder comprised of Portland cement, silica sand and special chemicals. They can simply be added to the concrete mixture at the plant to create a powerful moisture barrier in new concrete slabs and walls. There is no need for any sort of surface application at the construction site.

ICW can also be surface-applied to existing walls and slabs and incorporated into construction joints during construction or after the fact.

In building a concrete tanked structure, extra care must be taken when waterproofing construction joints, since these areas are most vulnerable to cracks and leakage. Historically, the best option for waterproofing joints was to place a plastic barrier or bentonite strip into the joint before an adjoining wall was poured. However, this waterstop method is unpredictable at best because physical barriers easily become dislodged or damaged during subsequent concrete pours, rendering them ineffective and leaving joints susceptible to leakage.

As part of their overall waterproofing systems, some of the better ICW manufacturers offer special crystalline waterstop systems that replace physical barriers, cost less and are easier to install. And since crystalline technology migrates from the joint into the surrounding concrete, waterproofing is not compromised even if the surface-applied ICW waterstop products are chipped or damaged over the life of the structure.

Is ICW Right For Your Concrete Water Containment Structure?

Although waterproofing is important for any concrete structure, it's particularly vital for facilities such as drinking water tanks, wastewater treatment plants and water reservoirs, where leakage and contamination are among the most common causes of service interruption. Integral crystalline waterproofing offers a number of unique features and benefits that make it an ideal system for waterproofing concrete tanked structures.

- By permanently blocking water penetration from all directions, ICW halts the migration of waterborne contaminants such as chemicals, chlorides, sulphates and silt, protecting the integrity and purity of potable (drinking) water.
- Because it stops water migration through concrete, ICW protects reinforcing steel from corrosion due to moisture penetration and waterborne chemicals, prolonging the life and integrity of the tank.
- ICW provides a proven, reliable waterproofing solution for zero-tolerance areas such as walls and structures adjacent to electrical, equipment or computer rooms, where even a small amount of leakage or contamination could prove disastrous.
- Some ICW products are certified non-toxic by NSF International, a widely respected third-party certification provider that develops national standards for food, indoor air, the environment and water, meaning they are safe for use in structures where potable water is stored.
- In sub-grade tanks, where cracking and leakage are difficult to detect and even more difficult to repair, ICW's durability and self-sealing properties provide an extra level of security and peace of mind.

Can ICW Be Used in Existing Concrete Water Containment Facilities?

Yes. Many ICW manufacturers produce a cementious formula that can be brush-applied to existing concrete structures to repair existing cracks, fortify and waterproof concrete and protect against contamination and steel reinforcement corrosion. The best systems may be applied on the negative side of the concrete against the water pressure where access to outside walls may be difficult or impossible. Allowing repairs to take place without digging up the perimeter, destroying landscaping and incurring extra cost.

Once applied to existing concrete, ICW chemicals are absorbed into the concrete by capillary action (the natural wicking movement of liquids through a porous structure) and diffusion (the natural movement of chemical molecules.) Once inside the concrete, ICW chemicals begin growing crystals and filling the spaces between concrete particles. The majority of active crystalline chemicals migrate into the concrete within the first 28 days, meaning the surface-applied product can be completely removed from the surface after this time without impacting its waterproofing properties.

400m^3 of ICW-treated concrete were used in the post-tension tank at the Seletar Water Reclamation Plant. The tank, which was completed in Spring 2004, is performing well and remains leak-free. ***AW***

Leo Connell is Marketing Manager with Kryton International, which offers a full range of integral crystalline concrete products including Krystol Internal Membrane (KIM) and Krystol T1/T2. Kryton International products are distributed in more than 40 countries worldwide. For more information, visit www.kryton.com or email the editor of Asian Water at vikass@singnet.com.sg.