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Serving the Building, Construction Machinery, Roads & Power Generation Sectors in the Middle East & North Africa - Since 1983

تخدم قطاعات البناء ومعدات الإنشاءات والطرق وتوليد الطاقة في الشرق الأوسط وشمال أفريقيا - منذ ١٩٨٣

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Green Concrete Waterproofing Technology Reaches Important Milestone

An established green technology to waterproof, protect and repair concrete structures for a wide variety of new and existing applications – Concrete Waterproofing by Crystallization (developed in British Columbia, Canada) – has reached a significant milestone: its 40th year of use in thousands of construction projects around the world, including projects in the MENA region. Four decades is a period traditionally cited in the construction industry as the "proof" of a technology's effectiveness. The crystalline technology is judged to be one of the most effective, efficient and economical solutions to protect concrete from water ingress. The technology's 40th anniversary is being observed in stages, reflecting the fact that, since 1970, the technology has been successfully specified in more than 70 countries.

Concrete waterproofing by crystallization uses concrete's inherent water permeability to deliver crystalline chemicals that plug the material's pores and bridge micro-cracks that occur as the concrete dries and shrinks. The crystalline waterproofing chemistry can be easily introduced into new concrete as an admixture, a dry-shake product, or a surface-applied coating. For existing (i.e., cured) concrete, surface-applied coatings are used.

The concrete waterproofing chemistry has played a crucial role in one of the most visible of recent construction projects in the MENA region, the Dubai Metro Project. About 10,000 kg of **Xypex Concentrate** was used for a 13.5 km stretch of a tunnel all along the channel drain. The technology is getting rave reviews, especially because the concrete had begun to deteriorate badly prior to the decision to introduce the proprietary concrete waterproofing protection. "We are pleased to certify," said **Mohammad Tanvir Siddique**, Deputy Construction Manager for the JT Metro – Dubai Metro Project, "that the crystalline waterproofing material such as the Concentrate product has successfully fulfilled our stringent requirements... We are quite satisfied with its performance and incorporated the same in the maintenance manual for future usage." The **Road Transport Authority (U.A.E.)** has revealed that it is recommending the same technology be used in other future mass transport projects in U.A.E. Similar success with concrete waterproofing by crystallization has been attained with other projects in the region, such as the Welcome Pavilion inside the Ferrari Experience in Abu Dhabi. Severe cracks had developed in the lower deck of the Welcome Hotel Pavilion water feature area, an oval-shaped building with an ETFE roof sur-

rounded by cascading water fountains. Different forms of the crystalline technology were used to repair shrinkage cracks. A coating was used to waterproof the deck's concrete. "We are very satisfied with the concrete waterproofing by crystallization performance in the Ferrari Experience Project and ensure that we will use the same in other projects from the inception for better performance and durability of concrete," said **Mohd Farhatullah**, QA/QC Manager of **Interbeton Abu Dhabi**. Because concrete is permeable to liquids and gases, porous conditions can create multiple problems within a building or other structure due to moisture penetration. The infiltrating water, and harmful chemicals dissolved within, also can compromise the concrete.

Adding to its appeal in the MENA region, the crystalline treatment is pH specific, not chemical specific. Its ability to prevent corrosion due to aggressive chemicals is measured by its ability to withstand a pH range of 3.0 – 11.0 constant contact (and 2.0 – 12.0 in periodic contact). The crystalline technology uses water in the concrete's capillary tracts as a diffusing medium to carry waterproofing chemicals into the concrete. The chemicals migrate through the waterways of the saturated pore network, where they react and grow non-soluble, needle-like crystals that plug the pores. Within a few weeks of crystal growth, liquids can no longer pass through and the transmission of gases is significantly restricted. The effect is permanent. In fact, the technology will even self-seal new micro-cracks if and when they occur years after the original application, a fact referenced in a November 2010 report (ACI 212.3R-10) by the **American Concrete Institute®**. The ACI report also notes "the crystalline deposits develop throughout the depth



of the concrete and become a permanent part of the concrete mass... [and] resist water penetration against hydrostatic pressure." The crystalline chemistry delivers an integral waterproofing system without the exposure disadvantages (from tearing or detachment) presented by external barrier/membrane solutions. It also is generally less costly and more convenient than external barrier approaches.

Crystalline waterproofing protects the environment from contamination caused by wastewater leakage and makes the construction process greener by eliminating the need for membranes manufactured with plastics, asphalt, polymer resins, solvents, aromatics and other materials with high energy manufacturing costs. In addition, the crystalline waterproofing technology is non-toxic, contains no VOC's (volatile organic compounds), and is NSF-61 approved for potable water by NSF International, a widely-accepted, independent source of public health and safety standards around the world.

Furthermore, the Concentrate product also has received WRAS approval for potable water for use with water at a temperature up to 50°C as per MENA region Water Authorities statutory requirement. (WRAS Test Report MA4049/K). The Ras Laffan Reservoir in Qatar, part of the highly prestigious Ras Laffan-C

IWPP project, holds 65 million gallons and produces 275,000 cubic meters of potable water per day. The reservoir project received approval from Qatar's Government Water and Public Health Department. It is one of the largest single-structure potable water reservoirs in the world, serving 40 percent of Qatar's water requirements. The two-coat system of the Concentrate was used to waterproof and protect 37,999 square meters of potable water tanks. The benefits of this technology – waterproofing, enhancing structural durability and the ability to resist aggressive chemicals – in this case, very high salt content – made these products the preferred choice for this project. The crystalline technology was also used on a cooling tower, sewage treatment plant along with caissons in Ras Laffan Nakilat Shipyard project.

In addition, again because the crystalline treatment is pH specific, coating treatments were successfully used in projects such as part of the Ras Laffan WWTP and chemical holding tanks for the QAFCO-5 Ammonia and Urea expansion project in Massied Industrial City. Ras Laffan-C IWPP will be the largest integrated water and power plant in the region, providing 30 percent of Qatar's electricity (and providing electricity to other Gulf States through a regional grid).

The need for improvements in water and wastewater treatment systems around the world is acute. The U.S. Cen-

ters for Disease Control and Prevention (CDC) – citing figures from the World Health Association (WHO) and UNICEF – provides disheartening information about the global state of water, sanitation and hygiene:

- Unsafe drinking water, inadequate availability of water for hygiene and lack of access to sanitation together contribute to about 88% of deaths from diarrheal diseases, or more than 1.5 million of the 1.9 million children younger than 5 years of age who perish from diarrhea each year, mostly in developing countries. This amounts to 18% of all the deaths of children under the age of five and means that more than 5,000 children are dying every day as a result of diarrheal diseases.
- Worldwide, 884 million people do not have access to an improved water source.
- According to the World Health Organization and UNICEF, improved sanitation could save the lives of 1.5 million children per year who would otherwise succumb to diarrheal diseases.
- An estimated 2.6 billion people lack access to improved sanitation (more than 35% of the world's population).
- The impact of clean water technologies on public health in the U.S. is estimated to have had a rate of return of 23 to 1 for investments in water filtration and chlorination during the first half of the 20th century.
- Water and sanitation interventions are cost effective across all world regions.

These interventions were demonstrated to produce economic benefits ranging from USD5 to USD46 per USD1 invested.

- Improved water sources reduce diarrhea morbidity by 21%; improved sanitation reduces diarrhea morbidity by 37.5%; and the simple act of washing hands at critical times can reduce the number of diarrhea cases by as much as 35%. Improvement of drinking-water quality, such as point-of-use disinfection, would lead to a 45% reduction of diarrhea episodes.

The above CDC statistics and other information can be found at http://www.cdc.gov/healthywater/global/wash_statistics.html

The United States must get its own house in order. The antiquated infrastructure in the U.S. remains a serious concern, and the scope of the challenge can seem overwhelming: in a 2004 report, the U.S. Environmental Protection Agency (EPA) estimated that 34.4 billion gallons of wastewater were transported and treated each day in the United States by more than 21,600 publicly owned treatment works (serving 78 percent of the U.S. population). The EPA estimates the network of sewer lines underground in the United States measures 2 million kilometers. ■

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لقد حققت تقنية عزل المياه عن الخرسانة بواسطة التبلور (طُورت في كولومبيا البريطانية في كندا) نتيجة مهمة: أربعين عاماً من الاستعمال في الآلاف من مشاريع البناء حول العالم بما فيها مشاريع في منطقة الشرق الأوسط وشمال أفريقيا. وتجدر الإشارة إلى أن أربعة عقود في صناعة البناء تشكل دليلاً على فعالية تكنولوجيا متطورة. أنشأت هذه التقنية الصديقة للبيئة لحماية الأساسات الخرسانية وعزلها عن الماء وإصلاحها لمجموعة واسعة من التطبيقات الجديدة والموجودة أصلاً. تعتبر التكنولوجيا المتبلورة إحدى أكثر الحلول فعالية وكفاءة وتوفيراً لحماية الخرسانة من تسرب المياه. يُحتفل بالذكرى الأربعين لهذه التكنولوجيا على مراحل مما يعكس حقيقة أن هذه التكنولوجيا ومنذ العام ١٩٧٠ قد استعملت بنجاح في أكثر من ٧٠ دولة. تحمي تقنية تصميم المياه المتبلورة البيئة من التلوث الذي يسببه تسرب مياه الصرف الصحي وتجعل من عملية البناء أكثر خضرة من خلال الاستغناء عن الأغشية المصنوعة من البلاستيك والأسفلت وراتنجات البولييمير والمذيبات والعطريات وغيرها من المواد ذات تكاليف الطاقة التحويلية المرتفعة. زد على ذلك فإن تكنولوجيا تصميم المياه المتبلورة غير سامة ولا تحتوي على مركبات عضوية متطايرة.