The Kryton Group of Companies.

ST. PETERSBURG WASTEWATER TREATMENT PLANT
CITY OF ST. PETERSBURG, RUSSIA

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QUESTIONS: 1-800-267-8280 or www.kryton.com

Above: the city’s new Southwest Wastewater Treatment Plant will significantly improve the region’s environmental health.

BACKGROUND
Home to more than five million people, the city of St. Petersburg, Russia has traditionally been one of the Baltic region’s greatest sources of pollution. However, by reducing the amount of untreated wastewater being released into the Baltic Sea by 50%, the city’s new Southwest Wastewater Treatment Plant will significantly improve the region’s environmental health.

The result of a large-scale cooperative effort between Russia, Finland and Sweden, the Southwest Wastewater Treatment Plant processes about 330,000 m³ of wastewater daily from the homes of 700,000 southwest St. Petersburg residents. The plant will dramatically reduce the amount of suspended solids, phosphorous, nitrogen and organics being discharged into the Baltic Sea. A 40% to 60% reduction in heavy metal salts is also expected.

With any wastewater treatment plant, concrete waterproofing is a major concern, since the migration of water or contaminants in or out of concrete cracks can affect the facility’s operations as well as the surrounding environment. The St. Petersburg plant’s project team was especially concerned about waterproofing the concrete tunnels that supplied water to the facility’s tanks.

Although the project contractor and engineers had considered using externally applied waterproofing membrane systems, they knew these systems eventually deteriorate, requiring expensive repairs and maintenance. Having ruled out external membranes, the project team was seeking a concrete waterproofing system that would be quick and easy to install, and, more importantly, would last the lifetime of the structure.

Above: With any wastewater treatment plant, concrete waterproofing is a major concern.

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1645 East Kent Avenue, Vancouver, BC Canada V5P 2S8 Tel.: 1-604-324-8280 Toll Free: 1-800-267-8280 Fax: 1-604-324-8899 E-mail: info@kryton.com Web: www.kryton.com
SOLUTION

In researching waterproofing alternatives, the St. Petersburg plant team considered Kryton International’s Krystol Internal Membrane™ High Strength (KIM™HS). KIM HS uses Kryton’s proprietary crystalline technology to transform concrete into a watertight barrier.

When added to a concrete mix, Krystol reacts with water and unhydrated concrete, causing millions of needle-like crystals to form, blocking the penetration of water and corrosive elements and resisting hydrostatic pressure. Over time, incoming water causes additional crystals to form, self-sealing small concrete cracks and reducing repair and maintenance time and costs.

At first, the team worried that promises of KIM HS’s easy installation, permanent waterproofing and self-sealing abilities might be too good to be true. However, after viewing test results from the Swedish Cement and Concrete Research Institute and learning that KIM HS had received an Agrément Certificate from the British Board of Agrément, they were convinced that this innovative product would perform as promised.

Approximately 2,000 kg of KIM-HS was used in the St. Petersburg Southwest Wastewater Treatment Plan. Three hundred cubic metres of KIM HS-treated shotcrete was applied to a thickness of 8-10 cm on the tunnel walls.

The wastewater plant was completed – under budget – in September 2005. Swedish Prime Minister Goran Persson, Russian President Vladimir Putin and Finnish President Tarja Halonen participated in the inauguration of the plant, which Finland’s Environmental Minister, Jan Erik Enestam, called “one of the most significant environmental projects in the Baltic region in recent years.”

The project contractors, NCC, Skanska and YIT, were highly pleased with the performance of KIM HS in the construction of the plant’s water tunnels and as a result, will likely use it in future projects in the region.

Benefits of the St. Petersburg Southwest Wastewater Treatment Plant should be visible as early as mid-2006. The reduction in the release of wastewater into the Baltic Sea will improve the condition of local waterways and beaches and, in the long term, the Gulf of Finland and the Baltic Sea as a whole.

OWNERS
City of St. Petersburg, Russia

CONTRACTOR
SWTP Construction Oy
(a joint venture of NCC, Skanska and YIT)

DISTRIBUTOR
Betongsystem Skandinavien AB

ARCHITECT/ENGINEER
Vahanen Oy
Saving costs efficiently with sealed tanking structures

Traditional membranes are expensive and time-consuming to install.

Waterproofing is an essential step in preventing water damage and preserving the integrity of concrete structures. In the case of concrete water tanks, ensuring effective, reliable waterproofing is even more critical.

Concrete tanks play a vital role in many communities. They function as containers for drinking water, storage tanks for wastewater treatment plants and water storage reservoirs. Not only is a leak in facilities like these expensive and time-consuming to repair, it can be very inconvenient and a tremendous health hazard for communities.

Protecting a city’s water supply from leakage and contamination is of utmost importance. If waterborne chemicals enter the drinking water supply, the water may become unsafe to consume. In drought-affected areas, leakage from a reservoir can be a devastating loss for residents and extremely costly to repair. In addition, wastewater leaking from treatment plants can cause lasting environmental problems by contaminating the ground.

Effective waterproofing is especially important in underground or partially buried concrete tanks. Below grade cracks and leaks may be more difficult to detect, as well as more expensive and time-consuming to repair.

The vast majority of concrete will eventually crack and leak due to shrinkage, settling, seismic activity and other factors. The best solution for protecting concrete tanked structures, and keeping water in and contaminants out, is to plan ahead and invest in a high quality, long lasting concrete waterproofing system.

The Seletar Water Reclamation Plant is part of a network of water treatment plants in Singapore. It is a key component in the country’s plan to become self-sufficient in the production of fresh water and to also reduce the quantity of water it must import. The Seletar plant processes nearly 250,000 cu m of wastewater per
day from the city's sewers. Using reverse osmosis and conventional water treatment, the plant produces high-quality water that is suitable for use as drinking water.

The Seletar Water Reclamation Plant has recently added a new post-tension concrete containment tank to hold recycled water. The post-tension construction method incorporates steel strands that run throughout the concrete slab. While this concrete building method reduces cracking and enables slabs to bear more weight, it requires additional waterproofing to prevent corrosion and deterioration of steel cables.

Since there is always a risk that recycled water stored in the new tank could enter the country's water supply, all construction materials needed to be non-toxic. Furthermore, a tight construction timeline provided just 30 hours for the tank to be poured and set.

Recognizing that conventional waterproofing membranes deteriorate over time, the Seletar project architect specified a crystalline waterproofing admixture for the project. The project team used Kryton's Krystol Internal Membrane (KIM) admixture system because of its superior waterproofing and corrosion protection properties.

Certified safe for contact with potable water by NSF International, a well-known third-party organization that develops national standards for food, indoor air, the environment and water, KIM provided an ideal waterproofing alternative.

More than 400 cu m of KIM concrete was used in the Seletar water tank. By eliminating the time and costs associated with installing conventional membranes, KIM enabled the builders to meet their tight construction timeframe and financial obligations.

In the past, concrete tanked structures were waterproofed using external membrane systems; polymeric sheets or liquid-applied coatings installed on the exterior or positive-side of set concrete. These systems are designed to form a physical barrier around the concrete, preventing the passage of water.

However, membrane systems present a number of challenges. Traditional membranes are expensive and time-consuming to install. Sheet membranes are often punctured and torn during backfilling operations and can come apart at the seams during use, leading to difficult and expensive repairs. Membranes eventually deteriorate as well, leaving structures unprotected.

There can also be numerous negative environmental impacts from using conventional membrane technology. Often, membranes are applied by using adhesives with highly volatile organic compounds. The vapour from these compounds can cause respiratory problems for applicators and harm the atmosphere. In addition, membrane materials are often made from petroleum, an unsustainable resource which can be dangerous to the environment.

Kryton International's Krystol™ Concrete Waterproofing System overcomes many of these problems. Krystol technology transforms porous concrete into an impermeable barrier by becoming an integral part of the concrete matrix. The system includes:

- **Krystol Internal Membrane (KIM)** an admixture for new concrete construction
- **Krystol T1 and T2** a surface-applied system for repairing and waterproofing existing concrete structures
- **Krystol Waterstop System** a comprehensive system for protecting and waterproofing concrete construction joints

When added to a concrete mixture or applied to existing concrete, Krystol creates a chemical reaction that causes needle-like crystals to grow within the concrete. These crystals fill the spaces between concrete particles and permanently block the movement of water in all directions. If hairline cracks later form in the concrete, incoming water causes additional crystals to grow, self-sealing the cracks and stopping the migration of water.

By blocking water penetration, Krystol halts the spread of waterborne contaminants, protects steel reinforcements from corrosion and safeguards the purity of potable water. Certified non-toxic by NSF International, Krystol is safe for use in all facilities where potable water is stored.
The Krystol Concrete Waterproofing System was also chosen to waterproof the Southwest Wastewater Treatment Plant in St. Petersburg, Russia.

St. Petersburg, a city of five million people, has traditionally been one of the Baltic region’s greatest sources of pollution. Through the Southwest Wastewater Treatment Plant, the city aimed to reduce the amount of untreated wastewater being released into the Baltic Sea by 50 percent, therefore significantly improve the region’s environmental health.

The plant, which was the result of a large-scale co-operative effort between Russia, Finland and Sweden, processes about 330,000 cu m of wastewater daily from the homes of 700,000 southwest St. Petersburg residents. The plant was designed to dramatically reduce the amount of suspended solids, phosphorous, nitrogen and organics being discharged, as well as decrease heavy metal salts by approximately 40 to 60 percent.

The St. Petersburg plant project team was concerned about waterproofing the concrete tunnels that supplied water to the facility’s tanks. With ambitious goals of discharge reduction and environmental betterment, the team wanted to ensure the concrete structure was built to equally high safety standards; keeping contaminants out and water secure.

Although the project contractor and engineers had considered using external waterproofing membrane systems, they recognised these systems would eventually deteriorate, requiring expensive repairs. Having ruled out membrane technology, the project team began looking for a waterproofing system that would be quick and easy to install, and more importantly, would last the lifetime of the structure.

In researching waterproofing alternatives, the St. Petersburg plant team considered Kryston’s Krystol Internal Membrane-HS (KIM-HS). KIM-HS is a variation of KIM and can be used in areas where freeze-thaw conditions are not present. KIM-HS uses Kryston’s proprietary crystalline technology to transform concrete into a watertight barrier.

At first, the team questioned whether Kryston’s product could deliver all it promised. After viewing test results from the Swedish Cement and Concrete Research Institute and learning that KIM-HS received an Agrément Certificate from the British Board of Agrément, the team was convinced the product would perform.

Approximately 2000 kg of KIM-HS was used in the Southwest Wastewater Treatment Plant. In addition, 300 cu m of KIM-HS-treated shotcrete was applied to a thickness of eight to 10 cm on the tunnel walls.

The plant was completed on time and under budget in September 2005. Then-Swedish Prime Minister Goran Persson, Russian president Vladimir Putin and Finnish president Tarja Halonen participated in the inauguration of the plant, which Finland’s environmental minister at the time, Jan Erik Enestam, called “one of the most significant environmental projects in the Baltic region in recent years.”

When choosing a waterproofing system for tanked structures, developers, architects and engineers should take the time to assess each system, bearing in mind the specific requirements and challenges of the project. By asking questions, carefully reviewing the literature, and speaking with manufacturers’ technical service representatives, decision-making should become easier. In most cases, a manufacturer’s field representative may be able to visit the site to provide advice and guidance.

Investing the time to research, compare and select the best waterproofing system for water tanks will not only save time and expense in the future but will also provide peace-of-mind to the community by knowing their water supply is safe and healthy for many years to come.

Enquiry: leo@kryton.com