

Welcome to another edition of the Penetron Newsletter,

Across the globe, many construction sites continue to rely on conventional, high-carbon-emitting concrete waterproofing materials, like membranes, for below-grade applications. In this edition, we explore the critical need to move away from these materials and highlight a proven, more sustainable alternative. This innovative solution not only enhances the durability of concrete structures but can also significantly reduce the carbon footprint (CFP) of construction projects, paving the way for a greener and more efficient future in construction.

Discover how Penetron solutions have been instrumental in safeguarding structures worldwide, ensuring their durability and performance over time. The PENETRON Worldwide section (below) highlights remarkable projects, such as the Adelaide Building, which has remained completely dry and protected in a challenging marine environment 12 years after its concrete was cast. Similarly, Parque do Pontal in Porto Alegre successfully withstood historic floods earlier this year, staying entirely dry thanks to the Penetron waterproofing system applied during construction.

Further, we provide a glimpse into our numerous global initiatives, including highlights from our recent training event at the Penetron Training & Technical Center in Athens, Greece, and our participation in the prestigious Big 5 Global exhibition in Dubai, UAE, in November.

Enjoy reading!

Florian Klouda
Director, International Account Coordination
PENETRON INTERNATIONAL

Eliminating High-Carbon-Emission Products in Below-Grade Waterproofing



The construction industry has a significant opportunity to reduce its environmental impact by replacing high-carbon-emission materials, particularly in below-grade waterproofing. Below-grade, or underground, waterproofing is crucial for protecting concrete structures exposed to moisture and hydrostatic pressure. However, traditional waterproofing solutions, such as bitumen, PVC, TPO, and EPDM membranes, substantially contribute to carbon emissions due to their production processes and limited durability.

The Carbon Footprint of Conventional Waterproofing Materials

Conventional waterproofing materials are petroleum-based and require energy-intensive manufacturing processes, resulting in high carbon footprints (CFPs). Their limited lifespan also necessitates frequent replacements, compounding their environmental impact. Below is a comparison of their CFPs¹:

- Bitumen: 13.40 kg eq CO₂/m²
- PVC: 20.25 kg eq CO₂/m²
- TPO: 7.13 kg eq CO₂/m²
- EPDM: 23.04 kg eq CO₂/m²

These figures underscore the urgent need for alternative waterproofing technologies that are both sustainable and durable.

A Low-Carbon Solution: PENETRON ADMIX

Crystalline, self-healing concrete extends the lifespan of structures by minimizing the need for repairs and replacements, further reducing the environmental impact over the structure's lifecycle.

Additionally, reducing the use of Ordinary Portland Cement (OPC), a major contributor to CO₂ emissions, is vital for lowering construction's carbon footprint. This can be achieved by incorporating Supplementary Cementitious Materials (SCMs) like fly ash, slag, and silica fume, which replace part of the cement in concrete mixes. PENETRON ADMIX is fully compatible with SCMs and enhances the performance, durability, and lifespan of these low-carbon concrete mixes, even outperforming conventional durability mixes as per BS 8500-1 standards.

Environmental and Long-Term Benefits

PENETRON ADMIX, a crystalline waterproofing admixture, provides an innovative, low-carbon alternative to traditional surface-applied waterproofing membranes. Added to concrete during batching, PENETRON ADMIX transforms concrete into a self-healing, durable, and waterproof structure.

The carbon footprint of PENETRON ADMIX is significantly lower than traditional materials. For a 0.25 mm thick concrete layer, its CFP is approximately 1.22 kg eq CO₂/m², and even at the maximum dosage for high-performance concrete (4.0 kg/m³)², the CFP is only 4.9 kg eq CO₂/m³—a fraction of the emissions associated with conventional membranes.

Proven Sustainability Impact

Studies indicate that PENETRON ADMIX-treated concrete can reduce carbon emissions by an average of 20% and potentially up to 27% compared to traditional waterproofing methods. This equates to substantial reductions in CO₂ per square meter of construction, making it a significantly more sustainable choice.

Cost and Lifecycle Advantages

By replacing traditional membranes with crystalline waterproofing technology, construction projects not only contribute to improved environmental conservation, but also reduce costs over the project's lifecycle by minimizing maintenance and replacement needs.

In summary, PENETRON ADMIX is a proven, low-carbon, and high-performance solution that addresses both environmental and economic challenges in below-grade concrete waterproofing.

¹CFP values are adopted from comparative environmental life cycle impact of waterproofing solutions for flat roofs. Application of the studied solutions in the rehabilitation of military infrastructure (Miriana Gonçalves – MSc's Thesis – Técnico Lisboa, 2015)

HOW PENETRON WORKS



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WITNESS PENETRON'S CRACK HEALING ABILITY



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PENETRON WORLDWIDE

Penetron International Training Event, Athens, Greece

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Big 5 Global 2024

Parque do Pontal, Porto Alegre, Brazil: Innovative Watertight Structures for Extreme Weather Resilience

12 Years On: The Adelaide Condominium in Salvador, Brazil

Ferrari E-Building, Maranello, Italy

Panamericana Oestae Highway, Panama City, Panama

The Edge, Limassol, Cyprus

East Water Reclamation Facility, Clermont, FL, USA

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Penetron International Training Event, Athens, Greece

In mid-September, Penetron International held yet another training session for its global network at the Athens Training & Technical Center of Penetron Hellas.

From September 15-18, 2024, 39 attendees from 14 countries attended an intensive 2-day training session that covered all aspects of the application of the Penetron crystalline range of products, as well as additional products for repair and liquid sealers.

The event allowed participants not only to witness, but also touch and feel the application of a wide range of Penetron products. Attendees gained a deep understanding of the product and surface preparation, required tools, and other useful information and tips related to the application of our world-leading concrete protection solutions.

Paired with the renowned Greek hospitality, the event was rounded off with cultural excursions into ancient Athens, Greek dances, and Mediterranean cuisine.



Big 5 Global 2024

With over 2,500 exhibitors from more than 65 countries and an impressive 85,000 international visitors, Big 5 Global stands as the Middle East's premier construction event. In 2024, the event took place from November 26–29 at the Dubai World Trade Center.

As a long-standing exhibitor, PENETRON once again welcomed visitors eager to explore cutting-edge solutions for concrete waterproofing, durability, and sustainability. The booth became a hub for engaging discussions with existing and prospective clients, as well as anyone interested in learning how PENETRON's expertise can protect and extend the lifespan of concrete structures.

Thank you to the over 500 local, regional and international visitors and their interest in PENETRON solutions.



The Penetron Middle East Team at Big 5 Global

Parque do Pontal, Porto Alegre, Brazil: Innovative Watertight Structures for Extreme Weather Resilience



In April and May of 2024, Rio Grande do Sul, Brazil, faced unprecedented extreme weather, recording an astounding 420 mm of rainfall that led to flooding across more than 90% of the region. Put into perspective, the rainfall volume was equivalent to the total surface area of Luxembourg. These incidents highlight the urgent need for discussions surrounding the adoption of advanced self-healing technologies aimed at waterproofing and protecting concrete structures. Such innovations are essential for bolstering the resilience and longevity of buildings in the face of harsh weather conditions. A prime example of effective and resilient design is the Parque do Pontal project, which withstood record flooding levels in 2024 as the Guaíba River peaked at +5.37 meters.

The Parque do Pontal multi-use complex is a showcase of state-of-the-art engineering solutions. It sits right on the bank of the Guaíba river, covers 29,000 m², and contains a shopping mall, hotel and convention center built on a 2-level basement for underground parking.

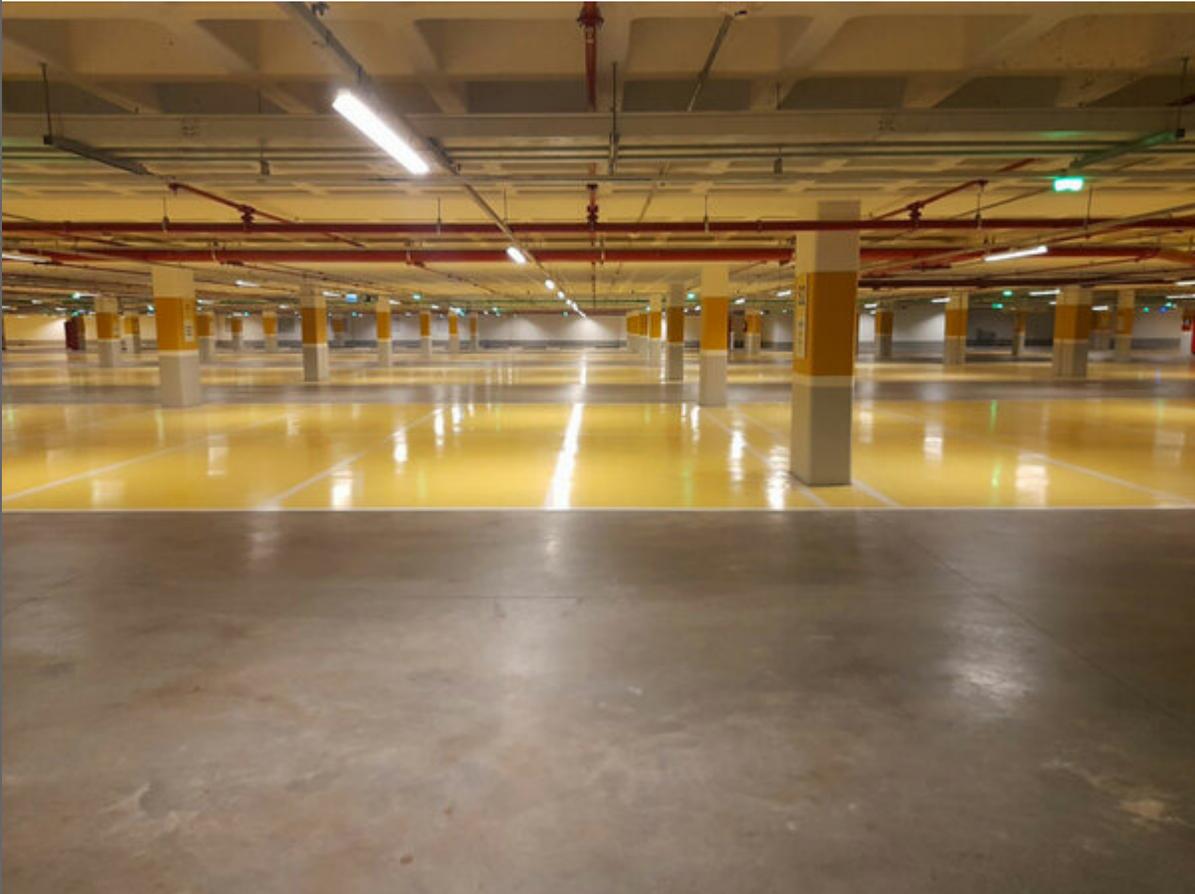
Renato Cortopassi, an expert geotechnical and structural engineer from Kali Engenharia, played a critical role in overseeing substantial structural changes to ensure the waterproofness and durability of the project. These modifications were aimed at ensuring the slab was supported by pillars instead of tie rods, which necessitated increasing the slab's thickness to 35 cm. The addition of the slab's dead weight also balanced rising loads—an essential feature for maintaining the structures' waterproofing integrity against climate-related impacts.

Eng. Cortopassi noted the significance of using watertight concrete—a process that involved incorporating PENETRON ADMIX and other components of the Penetron crystalline system, a stringent quality control process, also known as the Penetron White Tank System, and an in-depth understanding of local water table activity and potential flooding. The structural modifications successfully accommodated the hydraulic gradient required to manage surges of the Guaíba River, transitioning from -3.5 meters to +6.0 meters in anticipation of water level fluctuations. This approach was part of the original Technical Project Analysis for the Parque do Pontal's

underground foundation, which recommended avoiding expansion joints and tie rods due to their vulnerability to failure as points of weakness.

The construction of the Parque do Pontal's underground structure was meticulously executed. It consists of 6,000 m² of concrete walls and a massive 20,000 m² anti-flotation slab that extends 3.5 meters below the average water level of the Guaíba River. A wide array of specialized products, including PENETRON ADMIX crystalline admixture, were seamlessly integrated into the design to enhance impermeability. Furthermore, PENEBAR SW-55 and SW-45 waterstops and PENEBAR PRIMER were used in the concrete joints, while PENEPLUG (a fast-setting mortar), PENECRETE MORTAR (a crystalline repair grout), and a PENETRON slurry coating for crack repairs were also applied.

Penetron Brasil not only delivered the Penetron White Tank System at Parque do Pontal, but also offered consultancy services to the project to ensure the success of the project. Since then, Penetron proved to be the perfect choice as it effectively prevented any water ingress through the concrete structures of this iconic and complex project, even during some of the worst floods in the region since the 1960s. This outcome clearly underscores the adaptability of Penetron solutions in facing the challenges posed by global climate change.



Underground parking at the Parque do Pontal.

12 Years On: The Adelaide Condominium in Salvador, Brazil



Overlooking the serene Baía de Todos os Santos in Salvador, Brazil, the Adelaide Condominiums are a stunning example of luxury architecture that combines modern design with cutting-edge engineering. Nestled along the waterfront, this unique residential masterpiece by SQ+ Arquitetos Associados redefines sophistication with its sleek, linear silhouette—a modern counterpoint to the historic charm of Salvador's cityscape.

The Adelaide Condominium boasts 20 exclusive apartments, each ranging from 304 to 796 m², offering residents panoramic views of the Bahian coastline. High-end amenities elevate the experience, including private pools in select units, an infinity lap pool, private marina, pier, gym, restaurant, and an underground parking garage set 2.6 meters below sea level.

Building partially within the sea presented significant challenges, particularly for waterproofing and structural integrity. The Adelaide Condominiums required a resilient foundation capable of enduring hydrostatic pressure and the harsh marine environment. This is where Penetron Brasil stepped in, working closely with the client to implement a robust concrete protection strategy using a crystalline permeability-reducing admixture – an ideal solution for the project's demanding conditions.

The project's 2,500 m² base slab and in-situ cast retaining walls had to withstand a negative pressure of up to 4 tons per square meter, along with chloride exposure from the marine surroundings. Extensive testing by Penetron Brasil and contractor Andrade Mendonça verified that PENETRON ADMIX significantly lowered concrete permeability and effectively prevented chloride penetration, solidifying its status as the material of choice for the Adelaide Condominiums' foundation.

Supermix, the project's concrete supplier, seamlessly integrated PENETRON ADMIX into the concrete mix, optimizing the construction timeline and minimizing on-site labor and materials. For added protection, the Penetron System included PENEKRETE MORTAR and PENEPLUG were applied to repair tie-rod holes, honeycombs, and any cracks over 0.5mm, ensuring a waterproof foundation.

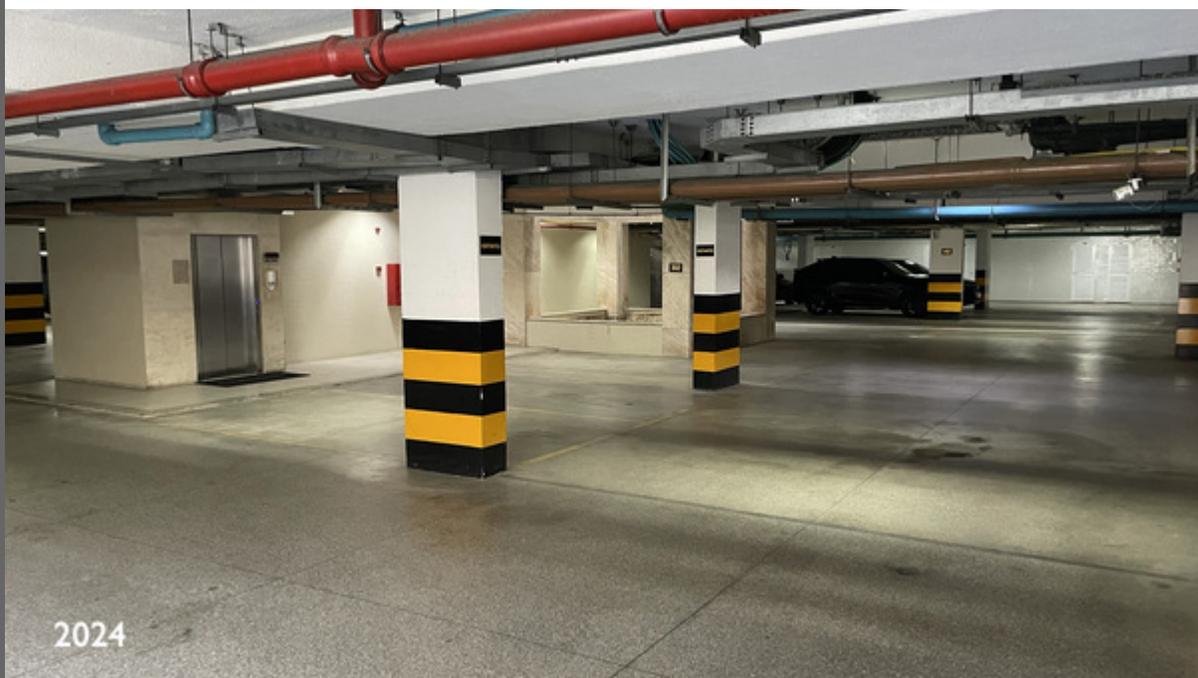
Completed in 2013, the foundation's waterproofing remains impeccable over a decade later.

Recent inspections by Penetron Brasil confirmed a dry, odor-free substructure in the underground garage – no small feat given the ongoing exposure to hydrostatic pressure and an aggressive marine environment.

Today, the Adelaide Condominiums stand as a testament to the long-lasting effectiveness of Penetron's concrete protection solutions, joining thousands of global projects that continue to benefit from this reliable, stand-alone waterproofing technology for years to come.



2012



2024

Ferrari E-Building, Maranello, Italy

In 1947, the first Ferrari automobile emerged from Enzo Ferrari's small factory in Maranello, Italy. Today, the name is synonymous with Formula 1 racing and the brand's sleek red (usually) sports cars, which are fast, blessed with a sonorous exhaust note – and expensive. The company's prancing horse logo is immediately recognized around the world.

While Ferrari has only two plug-in hybrid cars today – the SF90 Stradale (twin-turbo V8 with three electric motors) and the 296 GTB (twin-turbo V6 with an electric motor driving the rear wheels) – the company has announced plans to greatly expand the number of both EV and hybrid models. The first Ferrari EV is scheduled for launch in late 2025.

Ferrari's just-completed E-Building in Maranello is the production site for the brand's first fully electric vehicle. This new electric supercar factory will manufacture electric motors, inverters, and battery modules for EVs and hybrids. The facility also comprises an assembly line and paint shop where a new generation of handcrafted EV sports cars will take shape.

The below-grade areas of the E-Building contain the technical room, freight elevators, connecting tunnels to nearby facilities, and elevator structures. The engineers at Techbau, the project's designer and engineering consultant, specified a robust concrete waterproofing solution to protect the building's concrete foundation slab and retaining walls from high groundwater levels.

Because the construction site in Maranello showed high groundwater levels, the Techbau engineers contacted Penetron Italia for durable waterproofing protection for the below-grade concrete structures. After reviewing the project specifications, the Penetron technical team recommended PENETRON ADMIX SB, a crystalline waterproofing admixture.

Subsequently, PENETRON ADMIX SB was added to about 3,000 m³ of concrete for this brand-new Ferrari facility. PENETRON ADMIX SB was added at the batching phase and ensured an impermeable and significantly more durable concrete than a conventional concrete mix thanks to its unique self-healing capabilities. Adding crystalline technology as an admixture also simplified the application compared to other waterproofing methods, such as membranes and bentonite sheeting, and accelerated the construction schedule.



Panamericana Oestae Highway, Panama City, Panama

The Pan-American Highway is the longest drivable road in the world, comprising a network of over 30,000 miles (48,000 km). The main stretch between Prudhoe Bay, Alaska, and Ushuaia in

Tierra del Fuego, Argentina, is around 15,000 miles (24,000 km), except for a gap of approximately 62 miles (100 km) on the border between Colombia and Panama.

The Panamericana Oeste Highway in Panama is a corridor of the Pan-American Highway, which includes the newly completed highway now connecting Loma Cová (just west of Panama City) and Burunga to the north.

By upgrading this section of the Panamericana Oeste highway, the Government of Panama strives to ensure the continued economic development of the region. The completion of the project benefits the around 600,000 inhabitants of Panama West by reducing travel times and providing a connection to two soon-to-be completed projects: the fourth bridge over the Panama Canal and Line 3 of the Metro network.

Construction work on the US\$413 million project was carried out by the SOIMSA Facility, the general contractor, to rebuild 7 miles (11 km) of the Pan-American Highway. The route was widened from four to eight lanes, featuring three lanes in either direction as well as a central two-lane roadway to add capacity where needed during traffic peaks. In addition, the project included construction of three bridges, two highway spans, and five new interchanges.

When it came to the waterproofing specifications for the precast concrete beams of the access slab and the bearing slab of the bridges, PENESEAL PRO was the only product to meet all the requirements. Proven on similar highway and bridge projects around the world, PENESEAL PRO enabled the designer to seal the concrete road structures and allow an asphalt layer to be applied on top of the waterproofing layer.

Applied as a spray-on liquid sealer, PENESEAL PRO is a reactive sealer that penetrates the concrete to form a sub-surface gel barrier, which seals hairline cracks and protects concrete against water penetration. This sub-surface gel seals the pores, capillaries, and cracks of the concrete matrix and remains active as long as water is present, sealing any future hairline cracks.



The Edge, Limassol, Cyprus

Located in the eastern Mediterranean Sea, the Greek island of Cyprus has been an important Mediterranean trading center since ancient times. Today, as part of the EU, it has become a busy regional business and banking hub. With a population of over 195,000, the city of Limassol on the southern coast of the island is the second largest city in Cyprus after Nicosia.

The Edge, a US\$45 million, high-end office building in the Yermasoyeia district of Limassol, was designed by Photiou Architects. The distinctive building features a reflective façade and offers

3,300 m² of office space on six floors, a rooftop garden, 88 covered parking spaces, and unobstructed views of the city and surrounding region.

Due to both the marine environment typical for Cyprus coastal areas and the potential of sudden rainwater flooding from the adjacent park areas, Depcon Construction, the project's general contractor, and the engineers at KMS Globus required a durable concrete waterproofing solution for the building's concrete foundation structures.

After the general contractor reviewed similar commercial projects across Cyprus and Greece that successfully implemented Penetron products, PENETRON ADMIX, a crystalline waterproofing admixture, was specified as the concrete waterproofing solution. The admixture was added to the concrete mix for all below-grade structures, including the foundation slab, retaining walls, and elevator pits. PENEBAR SW, a swellable waterstop strip, was also applied to permanently seal all resulting construction joints.

Penetron Hellas SA worked closely with the client, providing on-site technical support during the planning and construction stages to ensure the waterproofing and protection of the concrete of this new Grade A office building addition to Cyprus.



East Water Reclamation Facility, Clermont, FL, USA

Completed in August 2024, the expanded East Water Reclamation Facility in Clermont, Florida, helps the community better conserve water resources by providing reclaimed water for irrigation purposes. PENETRON ADMIX SB, a crystalline waterproofing admixture, was specified to ensure optimal durability of the facility's new concrete structures.

Surrounded by gently sloping hills in the otherwise flat topography of Florida, Clermont is known as the "gem of the hills" and home to around 44,000 people. This quiet, residential city, only 22 miles (35 km) west of Orlando, is one of the largest metropolitan areas in the USA and a major tourist destination thanks to numerous amusement parks (Disney World, Sea World, and Universal Studios) and venues for conventions and cultural events. As a result, a large proportion of the local economy centers on tourism, including hotels and retail businesses.

To keep pace with the steady increase in the city's population, completion of the \$44.3 million project recently increased the treatment capacity of the East Water Reclamation Facility from 4.0 million gallons per day (MGD) to 6.5 MGD. The construction of new concrete structures included a new headworks structure (common wall with a flow equalization structure), a new biological nutrient removal reactor with anoxic and aerobic compartments, an internal recycle channel with a control gate, effluent baffles and weirs, an 85-foot (26-m) diameter clarifier, a new dual-chambered aerated sludge holding tank, and more.

The East Water Reclamation Facility will help the community conserve water resources by using reclaimed water. This reclaimed water is collected domestic wastewater treated to very high standards and then redistributed to irrigate fields, parks, and lawns in Clermont.

The project's original concrete waterproofing specifications identified both Penetron and a competitive product as potential solutions. Because Vogel Brothers, the general contractor, was unfamiliar with the Penetron System, Cemex, the ready-mix concrete supplier, showed how the superior performance of PENETRON ADMIX SB would be the best choice for the Clermont project – and also noted the built-in quality control measure in the form of a UV tracer, present in the bleed water during concrete placement and curing, which visually confirms the presence of the admixture in the mix.

PENETRON ADMIX SB, a crystalline waterproofing admixture, was added to 7,500 yds³ (5,740 m³) of concrete mix used for the new concrete elements of the East Water Reclamation Facility.

The durability of concrete structures in a plant like the East Water Reclamation Facility depends primarily on stopping water, effluent, and chemicals from entering the concrete, even under constant exposure to hydrostatic pressure. Because PENETRON ADMIX SB-treated concrete is impermeable and protects the imbedded reinforcement steel in the concrete from corrosion and resulting concrete deterioration, it was the optimal solution for Clermont's latest piece of important water treatment infrastructure.



