Welcome to another edition of the PENETRON industry Newsletter.

With an eventful 2016 fast coming to an end, we are pleased to present another concrete durability edition, expanding on the October 2014 and September 2015 series. In this issue, we take a closer look at another important cause of concrete deterioration: alkali silica/aggregate reactions (ASR/AAR) or “concrete cancer,” as it is commonly known. Prevention is simple: add PENETRON ADMIX to concrete to eliminate your risk of ASR/AAR by denying the necessary water to this reaction.

Scroll down for a look at some of the exciting international projects that benefitted from PENETRON solutions.

We wish all our readers a Happy New Year 2017.

Jozef Van Beeck
Director, International Sales & Marketing
Alkali-Silica Reaction (ASR) is the most common form of Alkali-Aggregate Reactions (AAR). It can cause severe expansion and cracking of concrete, causing it to lose strength and subsequently lead to failure.

A reactive aggregate forms alkali-silica gel (yellow) by absorbing water present in the concrete. The C-S-H gel exerts expansive pressure, cracking the aggregate and the surrounding cement paste.
ASR is a chemical reaction that occurs over time between the alkaline cement paste and reactive non-crystalline silica found in many common aggregates. The reaction of such aggregates with alkali hydroxide in concrete leads to the formation of a calcium-silicate-hydrate (C-S-H) gel that increases in volume by absorbing water from the surrounding cement paste or the environment. As it expands, the C-S-H gel exerts pressure inside the aggregate. This causes cracking of the aggregate and the surrounding cement paste, resulting in spalling and loss of strength. Subsequently, ASR can lead to critical structural problems and even the demolition of an affected concrete structure.

ASR cracking (typically map cracking) usually occurs in areas with a frequent supply of moisture, such as retaining walls exposed to groundwater ingress, marine structures in direct contact with salt water and other areas with capillary suction.

The conditions that lead to ASR include:

1. A sufficiently high alkali content of the cement (or alkali from other sources)
2. A reactive aggregate, such as chert
3. Water – the alkali-silica gel formation requires water; without water inside the concrete, ASR will not occur

The most effective way to prevent ASR, apart from limiting the alkali content of the cement and using non-reactive or less-reactive aggregates, is to prevent water from entering the concrete structure.

**PENETRON** products, such as **PENETRON ADMIX**, will protect concrete from water penetration and hinder alkali-silica gel formation by sealing microcracks, pores and capillaries with insoluble crystalline formations. Once activated, PENETRON crystals prevent the passage of water – even under high hydrostatic pressure, resulting in a completely dry and durable concrete structure. In addition, PENETRON products will self-heal new cracks as soon as moisture enters, preventing...
water from finding new ways into the concrete.

Map cracking in concrete

PENETRON WORLDWIDE

Wargaming Headquarters, Nicosia, Cyprus
The Wargaming Group is an international computer game developer and publisher headquartered...
Wargaming, with headquarters in Nicosia, Cyprus. Initially focused on turn-based strategy and real-time strategy games, the company switched to free-to-play online action games in 2009. Wargaming has become a market leader since scoring a breakthrough with “World of Tanks,” a military-themed, team-based game.

In 2015, the Wargaming Group moved its global headquarters into the new Wargaming HQ tower located near the Presidential Palace in Nicosia. Acquired from Rotos Developers for €20 million, the 75 m (248-feet) high tower is one of the tallest buildings in Cyprus. Covered by large photovoltaic panels to reduce energy consumption, it is also the first Class A energy-efficient building in Cyprus.

The project faced severe leakages after being treated with a crystalline admixture from another supplier. The local PENETRON team offered an efficient and permanent solution to eliminate the leakages before the handover to the Wargaming Group.

PENETRON INJECT was used to fill voids and cracks deep inside the concrete to push back penetrating water. Subsequently, the basement received a PENETRON coating treatment to ensure a completely dry and durable concrete structure. An optional, additional layer of shotcrete (containing PENETRON ADMIX) was later applied on request by the project consultant as a second layer of defense.
The first stage of Santiago Metro Line 3 (sections 1 and 4) is scheduled to open in 2017 (with phase 2 following in 2018 and phase 3 in 2020). It will connect the districts of Quilicura in the city’s Northwest with Ñuñoa and La Reina in the East.

Once completed, Line 3 will feature 22 stations on its 21.7 km (13.5 mile) track. Line 3 will connect with all other metro lines in Santiago (except for Line 4A) and complies with high security and passenger comfort standards. These include cameras inside trains, air conditioning, an overhead (catenary) transmission line, auto-drive, doors located on the platform, as well as connections to suburban trains.

**PENETRON** was chosen after the project consultant, Arcadis and the contractor, Ferrovial & Agroman realized that the PENETRON System would meet their stringent technical requirements, especially in regards to Chilean cement and aggregates.

Excellent technical support provided by the local PENETRON team, ample testing and certification of the beneficial effects on durability, concrete self-healing and waterproofing properties ultimately convinced Arcadis to change the previously-specified concrete mix design to a mix containing **PENETRON ADMIX**.

Since the beginning of the project in July 2014, 33,000 m³ (43,200 cubic yards) of concrete were treated with **PENETRON ADMIX**. By the time Line 3 (sections 1 and 4) is completed, a total of approximately 52,000 m³ (68,000 cubic yards) will have been treated.

To witness the full self-healing process of PENETRON ADMIX on Metro Line 3 in Santiago de Chile, [click here](#).
Tunnel section after activation of PENETRON ADMIX

Mall of Africa, Waterfall City, South Africa
The Mall of Africa is South Africa’s largest shopping mall ever built in a single phase, with 130,000m² (1.4 million square feet) of retail space available. The Mall will be home to over 300 shops, with numerous flagship stores. In addition to the vast array of both local and international brands, the Mall boasts uniquely identified court areas made for easy shopping navigation, as well as exceptional access, location and visibility. Located in Waterfall City, the Mall of Africa has an elegant design, which enhances the surrounding environment.

Designed by MDS Architecture, the mall’s architecture is inspired by Africa’s geology and iconic landscapes. The Mall of Africa is well situated to serve as a dominant super-regional mall.

To protect this US$348 million investment, various products of the PENETRON System were utilized during construction, mainly in the rainwater harvesting tanks and exposed parking decks.

A total of 9,650 m³ (12,600 cubic yards) of concrete supplied by 3Q Concrete were treated with PENETRON ADMIX and 1,650 linear meters (5,450 feet) of construction joints were sealed with PENEBAR SW-55.

Additionally, PENESEAL PRO was applied onto the exposed parking decks, sealing 1,520 m² (16,400 square feet) of concrete surface.
An Binh City, Hanoi, Vietnam

Developed by Geleximco of Hanoi, this US$500 million project includes the construction of eight towers of varying heights (28-35-floors) and two basements, all covering a total area of 45 hectares (112 acres).
When completed in 2017, An Binh City will provide over 356,000 m² (3.83 million square feet) of residential space, adding 2,732 luxury units to the local property market.

An Binh City is designed as a modern-day sanctuary, providing residents a peaceful and harmonious lifestyle with abundant and lush gardens, trees and wide-open spaces. Facilities include four-season swimming pools, retail outlets, restaurants, cafes, spa and wellness areas and a gym.

Having successfully used PENETRON in their An Binh Green Star project, the owner of An Binh City decided to forego a bituminous membrane system and a polymer coating solution in favor of a proven PENETRON crystalline protection system.

PENETRON PLUS was used extensively on the ground slab of the basement structure and the podium slab between the towers for a total treated area of 38,000 m² (409,000 square feet). PENETRON ADMIX was added to the 5,000 m³ (6,540 cubic yards) of concrete in the swimming pools, water tanks and other concrete structures. 4,000 m² (43,000 square feet) of retaining walls were treated with a PENETRON coating on the positive side to completely waterproof and protect the concrete against any water penetration.
Chuncheon is an inland city; the marine products are provided by distribution channels from the East or from the West Sea. In 2015, the Chuncheon government invested approximately US$10 million to build a modern Marine Products Distribution Center to supply fresh seafood to local citizens at affordable prices. The building consists of one basement floor, three above-grade floors, a seafood market, a raw fish center, cold storage and fish processing facilities, all in an open area covering 4,600m² (50,000 square feet).

During construction, a lot of high-pressure groundwater pushed through the basement wall, whereupon PENETRON ADMIX was added to protect the concrete structure, providing comprehensive and reliable waterproofing for the machine and fire pump rooms located in the basement.
South Quarter / Phase I, Jakarta, Indonesia

This uniquely designed multi-purpose complex stretches over an area of 7.2 hectares (17.8 acres). It features three office towers that will be complemented by two residential towers in phase 2 of construction.

Designed by Tom Wright of Atkins Limited, the traditional Indonesian rattan basket-inspired towers of South Quarter provide exceptional and inspirational working environments with large open spaces and lush greenery, while engineered for maximum sustainability, energy-efficiency and minimal water usage. The certified green development reduces the energy used for cooling by up to 35%, while the overall water requirements are reduced through rainwater harvesting, water usage reduction and wastewater recycling.

The 20-floor towers offer 2,200 m² (23,700 square feet) of floor space; each tower provides significantly larger Grade A offices than any other building in the vicinity. This allows for the accommodation of larger businesses and flexibility for expansion.

An exclusive retail area features an extensive selection of restaurants, convenience stores, coffee shops and other outlets under the roof of the SQ Dome.

The four-level basement is exposed to a high water table with high hydrostatic pressure, which posed a waterproofing challenge for this project. To ensure complete protection and durability, PENETRON ADMIX was used in the retaining walls and basement slabs at South Quarter. This was achieved by treating almost 20,000 m³ (26,160 cubic yards) of concrete. PENEBAR SW-55 waterstops were installed to seal the construction joints.
About 43,900m² (472,600 square feet) of concrete surfaces in the restrooms, balconies and roof structures were treated with **PENETRON**.