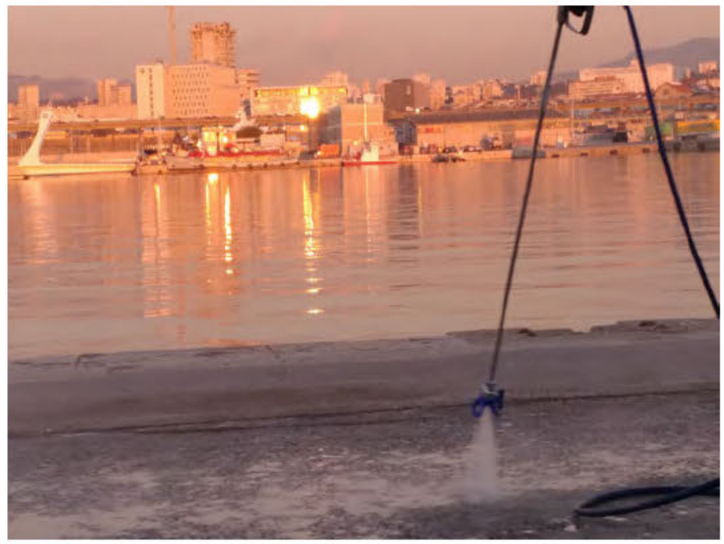
Spray-Lock®

CONCRETE PROTECTION



Saltwater exposure class?

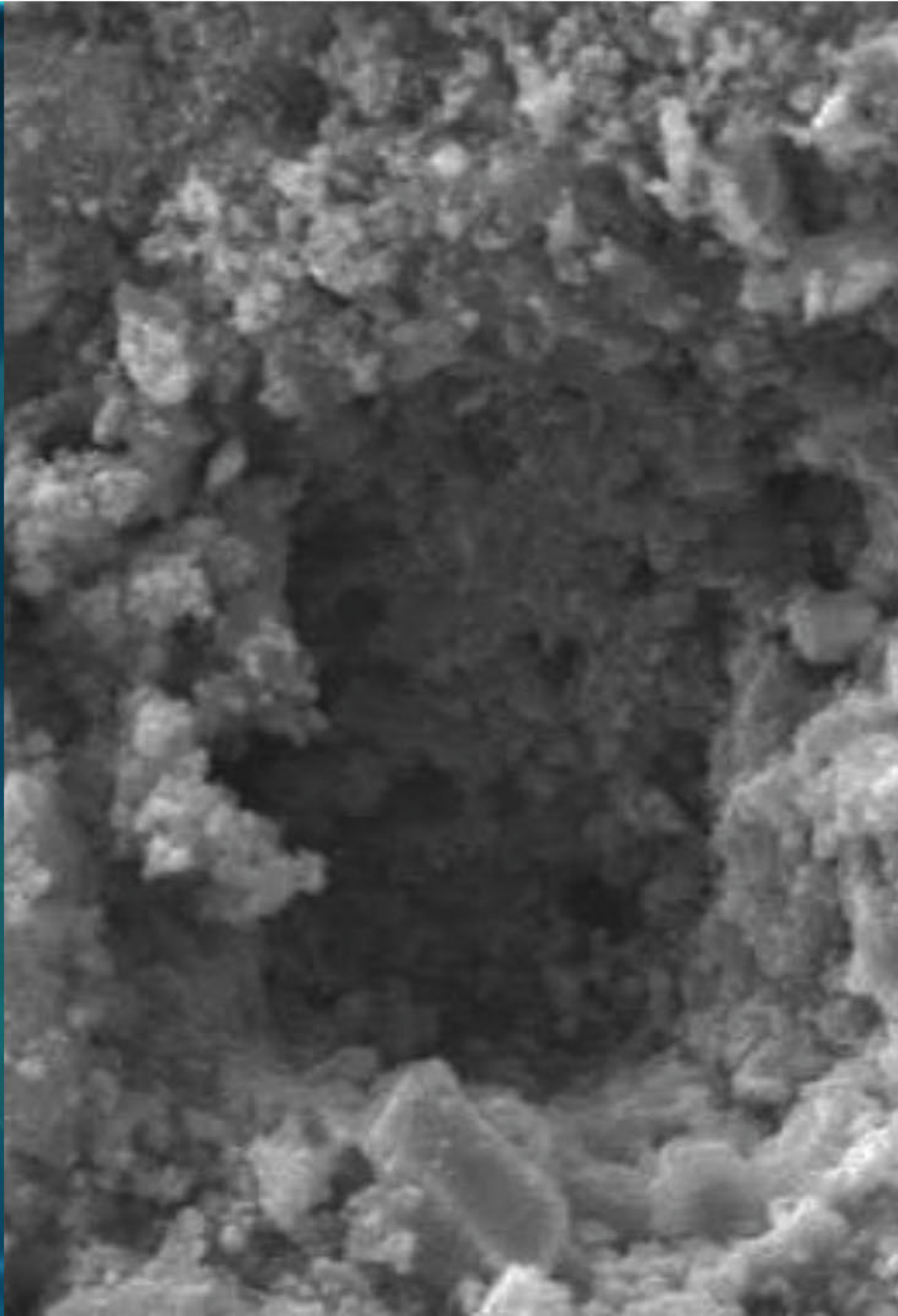
Keys to Longer-Lasting Concrete

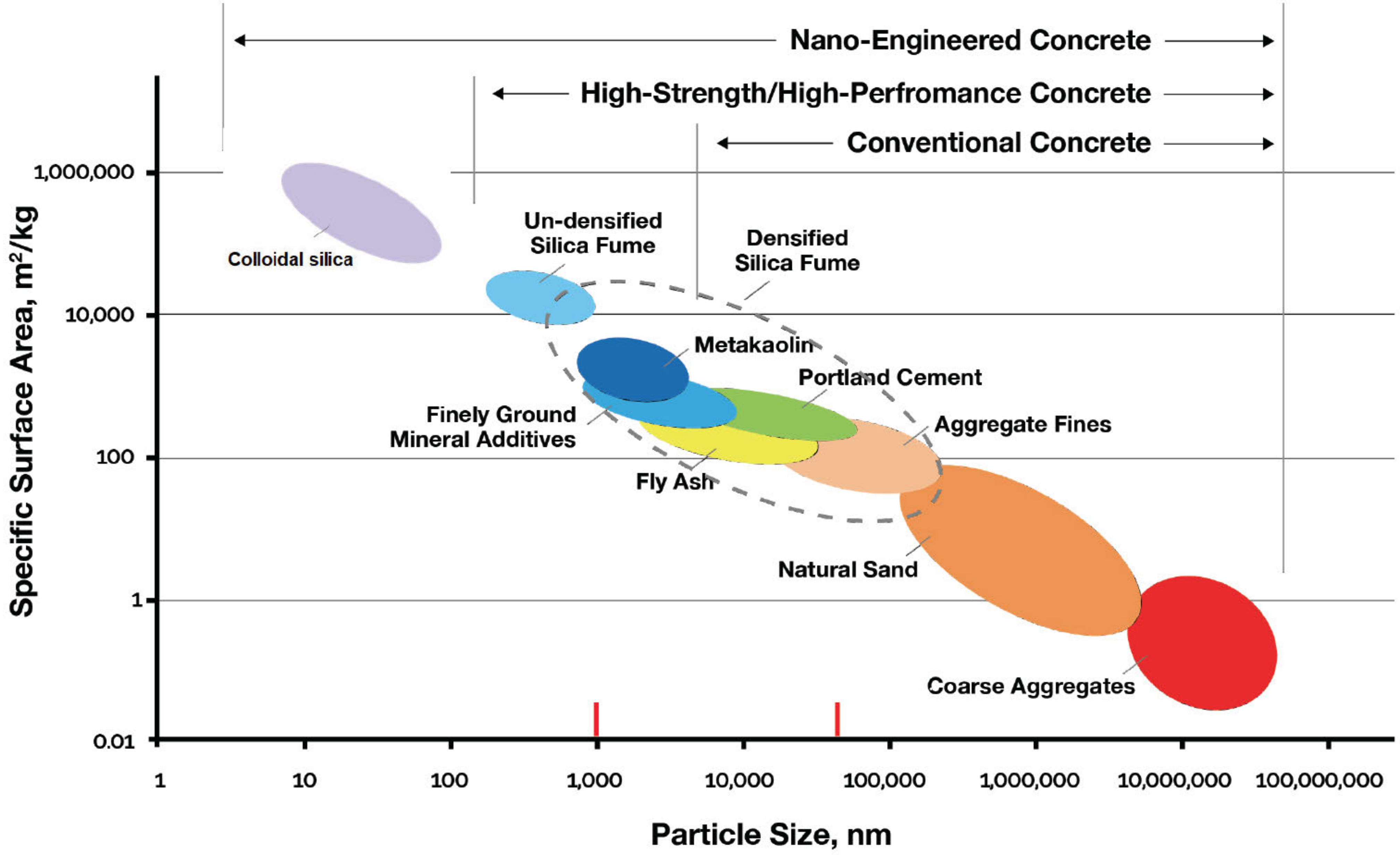
Contents

What is Colloidal Silica?

Silicon Dioxide on the nano-scale

Colloidal Silica can access most of the interconnected pore structure in concrete due to its size.





Compiled From: Birgisson B. Mukhopadhyay A.K. Geary G. Khan M. Sobolev K. (2012) "Transportation Research Circular E-C170: Nanotechnology in Concrete Materials" Task Force on Nanotechnology-Based

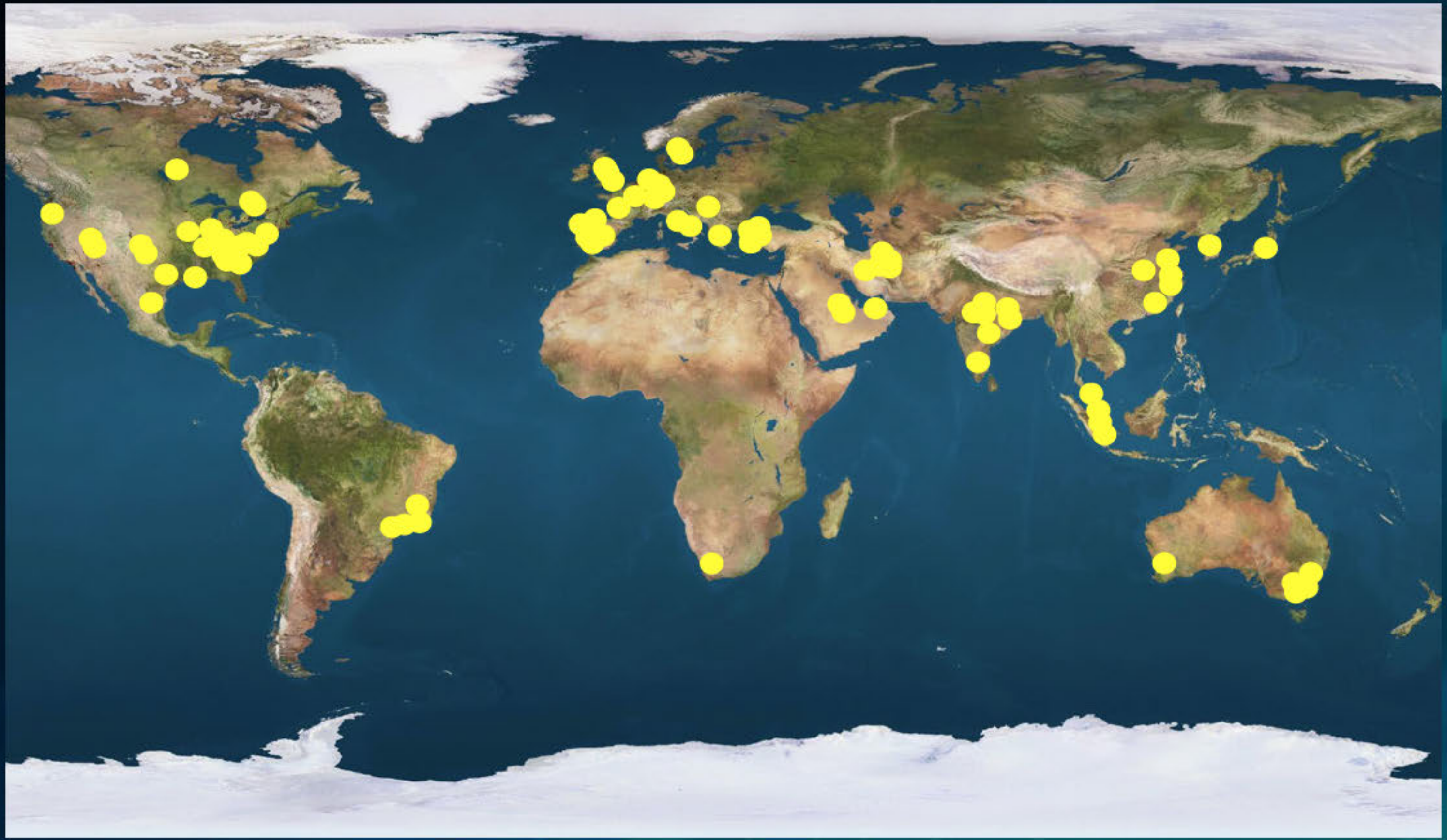
How is CS introduced to concrete?

As an additive at time of mixing

- Treats entire load of concrete
- Added at the batch plant into mixer trucks
- Stays in the concrete until calcium hydroxide becomes available from the cement/water hydration process then reacts. Permeability is significantly reduced.
- Some void space still present – capillaries and bleed water channels still form

As a spray-applied treatment

- Applied after voids have formed, effectively closes them in the interaction zone
- Penetration depth varies
- Can act as a curing mechanism when applied to new concrete
- Can also be applied to existing concrete



Since 2000, more than 50 research teams, spanning over 100 papers, have published results demonstrating the improved properties of concrete containing CS.

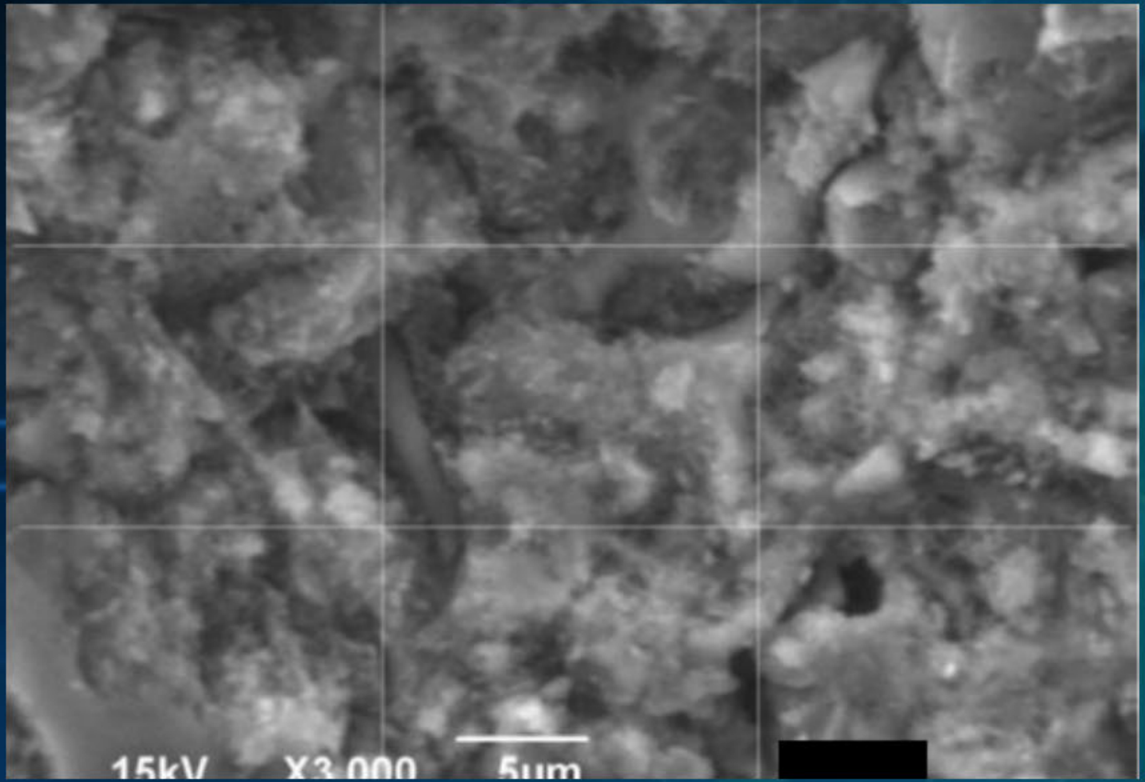
ASTM has two current working groups assigned to colloidal silica specifications.

ACI 241 Nanomaterials in Concrete addresses colloidal silica at length.

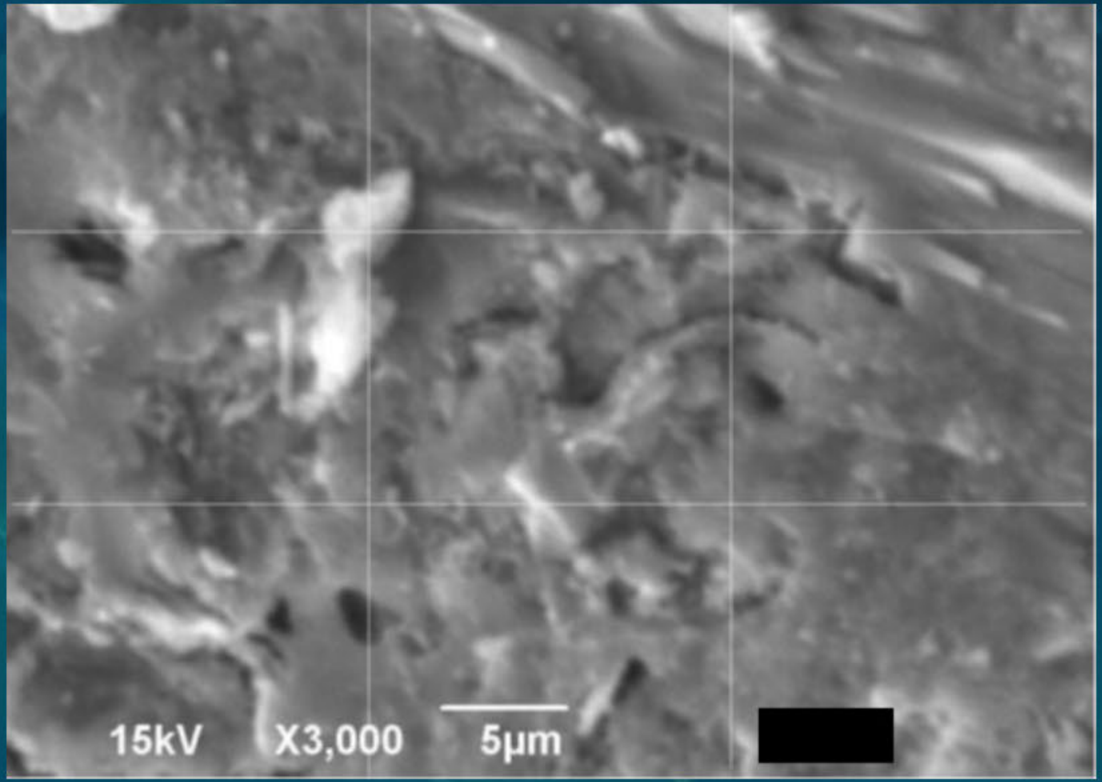
Colloidal Silica Science: It's Concrete

Effects on Permeability by Spray-Applied Colloidal Silica

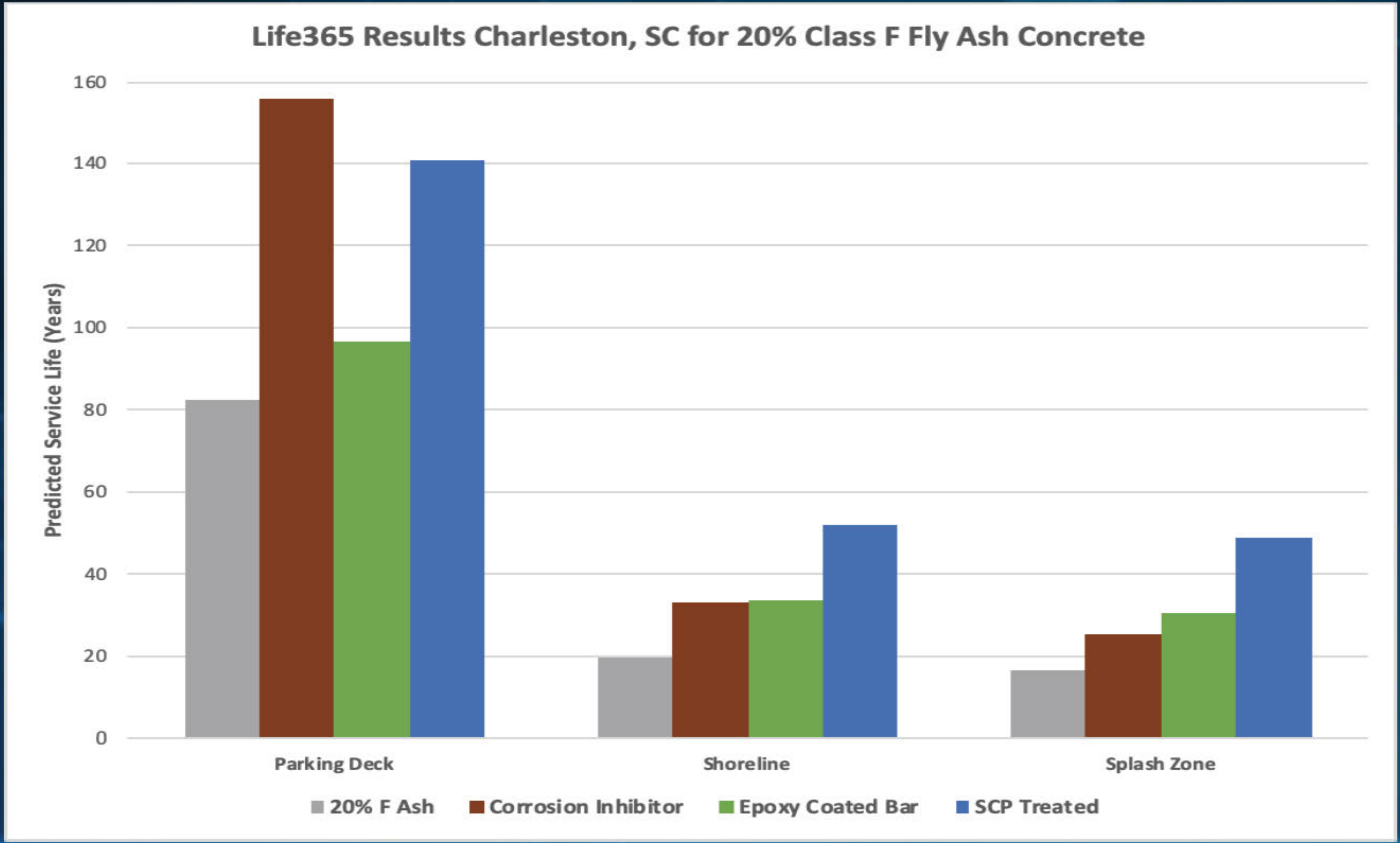
Untreated, 15 mm Depth



Treated, 15 mm Depth

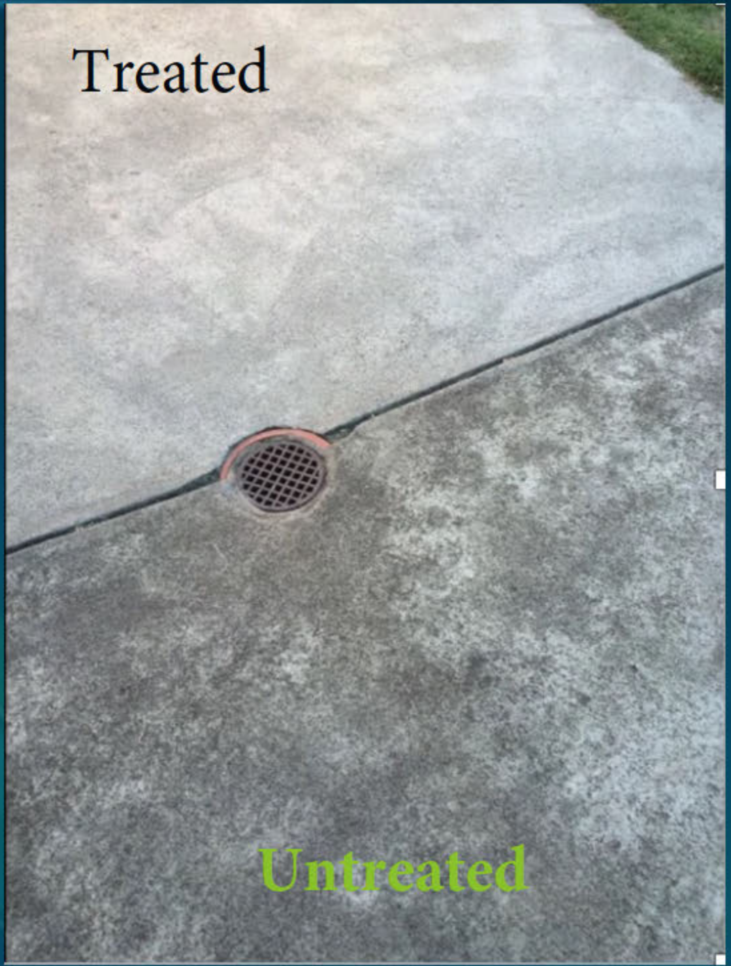


Corrosion Life Cycle Modeling Lab-Derived Permeability Data



SCP Treated vs. Non-Treated

Road Salt Storage Shed (Kingsport, TN)



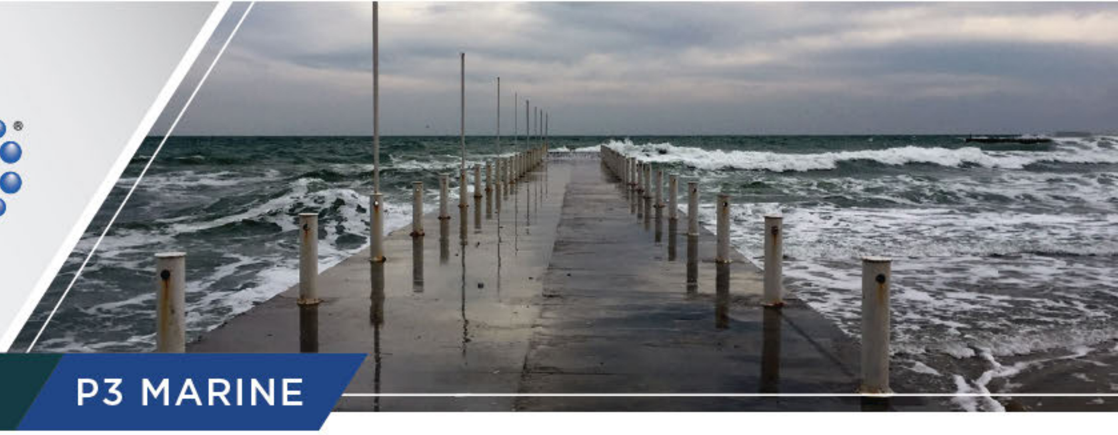
To Slow Penetration of Chlorides and Other Sources of Chemical Attack

- Bridges (deicing salts & salt water)
- Parking Decks
- Driveways
- Parking Lots
- Sidewalks

Colloidal Silica is…

- The best known provider of the pozzolanic reaction.
- A great way to reduce permeability of concrete.
- A treatment that lasts for the lifetime of the concrete.

Spray-Lock®
CONCRETE PROTECTION



PRODUCT INFO FLYER

P3 MARINE

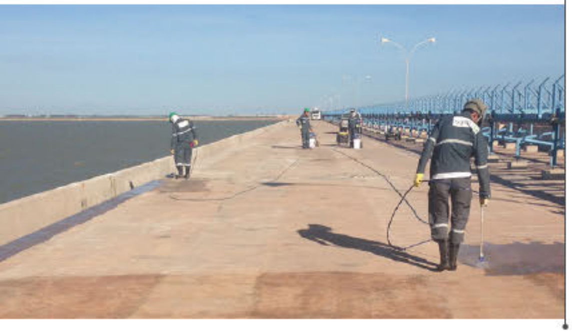
P3 Marine provides enhanced protection against:

Chloridesgi/saltwater

Physical attack elements

Splash zone conditions

Corrosion of reinforcement



Significantly Increase Concrete Life-Cycle Performance, EVEN IN THE Worst Conditions

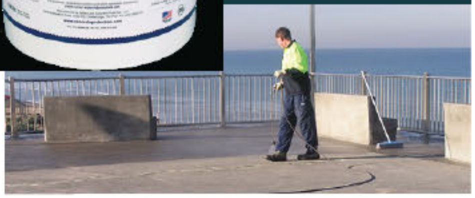
Concrete exposed to the most challenging and uniquely aggressive environments this world has to offer needs a protective technology that's the best the world has ever seen. **Spray-Lock Concrete Protection (SCP) technology is that shield of protection needed for these conditions.**

SCP technology takes the science and understanding of one of the best-known materials for concrete durability — amorphous silica — and takes it to the next level of use and application. *No other product on the market can provide the unique benefits* contained inside every single bucket of **P3 Marine.**

P3 Marine is SCP's top-shelf formulation that protects exposed concrete (0.5 m/0.0005 km from shore) from salt water and other chlorides, sulfates, and chemicals.

Benefits OF USE FOR New AND Existing Concrete

JUST A FEW OF THE INCREDIBLE ATTRIBUTES OF P3 MARINE



Better cure than moist curing

- Gives the best chance for concrete to reach maximum potential.
- Resists the harshest of conditions.
- Fills the concrete capillary and pore system with more concrete.

Decreased permeability & enhanced stability

- Permeability reduction of 90% or greater (EN 12390-8).
- Improvement in chloride diffusion by 50% or greater (ASTM C1556).
- Reduction of forced chloride ingress by 25% or greater (NT-492).
- Manage splash zone issues including abrasion resistance and chloride protection with one product.

Best treatment to slow down deterioration on existing structures

- Can be used to treat and seal clean, absorptive concrete.
- By blocking the ingress of contaminants, the concrete is protected, allowing for increased success of repair or intended use.
- Creates a permanent physical barrier to attack, as robust as the concrete itself.
- Rely on life-cycle improvements with a one-time application.

P3 Marine Sales Flyer
REV: A DATE: 09.09.2022

LEARN MORE 423.305.6151 SCPTech@spraylock.com concreteprotection.com

Spray-Lock®
CONCRETE PROTECTION

PRODUCT DATA SHEET

P3 MARINE

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Chattanooga, TN 37421
423.305.6151
SCPTech@spraylock.com
concreteprotection.com

P3 Marine is a spray-applied product, based on Spray-Lock Concrete Protection (SCP) colloidal silica technology, which provides a permanent improvement that increases the durability and life cycle of Portland cement concrete.

ABOUT THIS PRODUCT

P3 Marine is intended for use in areas where the concrete member is exposed to migration and diffusion of chlorides from saltwater, splash zones, potential liquid contaminants under hydrostatic pressure, regular and consistent exposure to detrimental conditions, or other similar severe sources of attack mechanisms.

P3 Marine penetrates into the accessible capillary system, reacting with the available free alkali found within, and primarily forming calcium silicate hydrate (C-S-H). It can be used at time of placement as the choice for curing and protection, or P3 Marine can be used on existing clean, hardened, permeable concrete.

P3 Marine technology was formulated to reduce the permeability of the concrete surface to reduce the impact of chloride and other salts as well as other contaminants into the concrete in a marine environment. With a superior cure (equal to or better than 28-day moist cure), the need for a curing membrane is eliminated, allowing foot traffic in just one to three hours.

P3 Marine provides permanent concrete protection while also providing improved conditions that allow concrete to become more durable and longer-lasting than untreated concrete. With over 40 years of industry proven performance, SCP technology is your solution to better concrete.

Recommended Equipment for Applications

Important: When using an airless sprayer on freshly placed concrete, be sure to adjust pressure settings so that no surface damage occurs. The use of centrifugal pumps is not recommended.

Use a low to medium pressure sprayer complete with an extension wand and fan tip spray size of 0.019-0.021 inches (0.48-0.53 mm) for vertical or overhead applications and fan tip spray size of 0.024-0.031 inches (0.61-0.79 mm) for flatwork applications.

Alternate spray system: Use an agricultural sprayer using an approximate 5 gallons per minute (18.93 liters per minute) diaphragm pump and fan tip spray size of 0.30-0.60 gallons per minute (1.14-2.27 liters per minute) for vertical or overhead applications and fan tip spray size of 0.50-1.0 gallons per minute (1.89-3.79 liters per minute) for flatwork applications. A backpack or Hudson type sprayer should be used if only applying one bucket or fewer of material.

TYPICAL APPLICATION RATE

Concrete
150 ft^2 per 1 gallon
(3.7 m^2 per 1 liter)

PERFORMANCE

Test Method Standard	Typical % Improvement
ASTM C1556	51%
ASTM C1803	58%
EN 12390-8	90%
NT-492	26%

Recommended Application Method

Important: Spray in a 50% overlapping pattern.

For slab applications, hold wand perpendicular to the surface and spray 6 inches (15 cm) from the surface. Apply product using the prescribed application rate for the area. If pooling or dry areas are observed while applying, use a broom to distribute material so that the product remains uniform throughout the application area. Do not allow excess material to dry on the slab. Remove excess P3 Marine product with a foam squeegee, broom, wet vac, or mop.

Note: Product not removed from the slab may become slippery in a wet condition.

Treated area can be opened to foot traffic one hour after treatment and all heavy equipment traffic 24 hours after treatment.

For vertical and overhead applications, hold sprayer wand perpendicular to the surface and spray 6 inches (15 cm) from the surface. Very light and repeated spray passes should be made over the same area using the prescribed application rate. For vertical application, begin at the bottom and go to the top.

Time of Placement

P3 Marine can be used at the time of placement. Application should be performed after final troweling has been completed and concrete can take foot traffic without damage. Final concrete finish must be unburnished prior to application.

Concrete Finish

The concrete surface finish is a key part of the P3 Marine application process. The surface finish should be discussed with the concrete foreman and the superintendent prior to concrete placement. The surface, if hard troweled, should be finished in an open fashion (unburnished), avoiding a burnished or black surface finish. P3 Marine needs a porous (open-matte) finish to penetrate into the concrete and perform as intended. SCP recommends observing the concrete finishers during the finishing process to ensure the concrete is not burnished.

P3 Marine can be applied to hand finished surfaces, broom finished surfaces, and bull floated surfaces.

Note: Extra time may need to be allowed for concrete to set on broom finished surfaces to ensure no damage to concrete from foot traffic.

Formed Surfaces

SCP recommends using a reactive, non-petroleum based form release. Use the form release based on the manufacturer's recommendations.

Prior to application of SCP products onto any formed concrete surface, SCP recommends performing a water absorption test to determine if the product will be able to penetrate into the concrete surface.

Accelerators

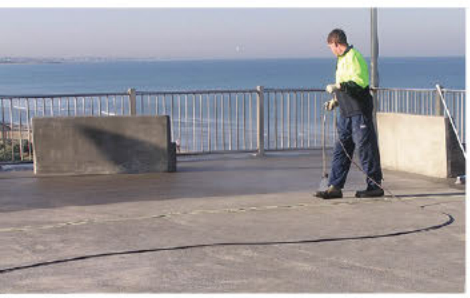
Accelerators are often used during colder months to accelerate the setting of the concrete. These admixtures will also accelerate the action of P3 Marine. If these admixtures are used (check batch tickets), applicators should test a small area prior to a full application. Tests should be conducted periodically. A test section measuring approximately 3 ft x 3 ft (0.914 m x 0.914 m) is recommended. Apply P3 Marine product to this area and wait 15 minutes. If the P3 Marine product begins to appear milky and turns into a gel or feels very slippery, then the accelerator is still active. Re-test until the product remains unchanged from its normal consistency. Once the SCP product remains unchanged on a test area for a minimum of 15 minutes, full application can begin.

Existing Concrete

The concrete surface needs to be structurally sound. If there are any concerns, consult with an engineer on the project or consult with a structural engineer. Any weak or degraded concrete surface or concrete exhibiting signs of scaling, delamination, or spalling must be mechanically removed to achieve a solid substrate. The concrete should be free of contaminants such as dirt, wax, oil, grease, curing compounds, adhesives, paint, or any other material that could prohibit P3 Marine from entering the concrete matrix. Always perform a water absorption test to determine if the product will be able to penetrate into the concrete surface.

Admixtures

The use of moisture vapor reducing admixtures (MVRA), integral waterproofing admixtures, or latex admixtures ***should not be used*** when utilizing P3 Marine spray-applied technology.



Topically Applied Concrete Products

There are many concrete additives on the market. Some of these will work in conjunction with P3 Marine, some will not.

If a monomolecular evaporation retarder (MMER) is used on the concrete, the MMER should be applied in accordance with the manufacturer's recommendations.

When specified, curing compounds (ASTM C309 or ASTM C1315 products) can be used but should only be used after the P3 Marine product application. If a curing compound is used prior to the P3 Marine product application, remove the curing compound prior to treatment.

ENVIRONMENTAL CONDITIONS

Hot Weather

One of the challenges of hot weather applications is rapid evaporation and unwanted gelling. SCP recommends pre-wetting concrete when surface temperature is above 90°F (32.2°C). Pre-wetting consists of spraying a light coat of water directly in front of P3 Marine product application. This process helps in preventing rapid evaporation of P3 Marine from the surface of the slab, allowing for better penetration into the hot concrete. P3 Marine should be removed before allowing to dry on the slab.

Cold Weather

Challenges faced during cold weather applications include low temperature application, accelerator addition, and shorter days. The minimum air and concrete temperature at which P3 Marine can be applied is 35°F (1.7°C) and rising. If an accelerator is used in the concrete mix, test a small area as described in the Accelerators section of this document. With shorter days during the winter months, longer set times could push P3 Marine application to a later time when temperatures are too cold. Application may need to take place the following morning. If this is the case, the concrete company may need to protect the concrete with blankets or other means.

Rain Event

A rain event is defined as liquid precipitation that is sufficient enough to cause standing water on the concrete structure. If a light mist is observed that causes no standing water, this is not considered a rain event and application does not require interruption.

If a rain event begins during an application, the portion of the slab that has been treated and squeegeed off is considered treated. If a portion of the slab is being treated and not squeegeed when it rains, P3 Marine will need to be reapplied after rain the has stopped. Mark the area last treated so that you have a reference on where to resume application after the rain event. After rain has stopped, the slab should be squeegeed to remove all standing water. Application can continue as normal, beginning after the last treated section of the slab.

POST-APPLICATION

Traffic

Foot traffic is allowed one hour after application. Equipment traffic is allowed after 24 hours or when the design professional decides the concrete is strong enough to handle the load.

Control Joints

SCP requests that control joints are cut ***after*** P3 Marine has been applied. If the control joints are cut prior to the placement of P3 Marine, the area will need to be cleaned to remove the residue dust from the cutting. ***P3 Marine can react with the dust creating a slick surface.***

NOTES

- ***Not suitable*** for use where coatings, coverings, or flooring may be applied.
- Like fresh concrete itself and other alkaline materials, product may etch glass, shiny aluminum, and brass if left to dry on the surface. Simply remove while wet.
- DO NOT apply on frozen substrate.

Packaging/Storage

P3 Marine is packaged in 5, 55, and 275 gallons. Product shall ideally be stored in a location that is dry and between 35°-100°F (2°-38°C) ambient temperature. Optimal storage is at the middle of the temperature range. Protect from freezing and direct sunlight. 5-year shelf life under proper storage conditions.

General Information

For safe handling information on this product, see the Safety Data Sheet (SDS).

Warranty

SCP warrants the product to be free from material defects provided that the product was sold within its identified shelf life and stored according to guidelines on product packaging. SCP's sole liability shall be limited to the purchase price paid by the customer for SCP product for the quantity of defective material.

Mock-ups, testing, or sample applications to determine fitness of products for a particular use are the responsibility of the user. In-house and independent testing supports the instructions and claims made in this document. Due to the variation in job conditions, surface preparations, concrete substrates, and application methods, SCP cannot ensure uniformity in product performance.

PRODUCT ATTRIBUTES

Color
Clear

Odor
None

Specific Gravity
1.10

pH
11.5 +/-

Flammability
0 (non-flammable)

VOC/VOS Content
0.0 g/ml

Clean-up Solvent
Water

Environmental Impact
None/Neutral

User Status
Friendly

QUESTIONS? 423.305.6151
SCPTech@spraylock.com

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Web: www.spraylockcp.com

SCP Tech Brief: Chloride Mitigation

How Spray-Lock Concrete Protection Works

Spray-Lock Concrete Protection (SCP) spray-applied technologies are made up of post-initial set applied colloidal silica. Because of the colloidal silica's extremely small particle size, it has a tremendous amount of pozzolanic potential, greater even than silica fume[1]. This reaction takes place in the capillary voids and pore space in concrete, filling the void space with C-S-H, the same reaction product concrete relies on for most of its strength and durability. SCP products are used worldwide as a concrete matrix waterproofing agent because it restricts the movement of water through concrete, even under hydrostatic pressure. Because of this waterproofing action, water-borne contaminant ingress is considerably reduced, including chloride transport. This ability to restrict the movement of water and chlorides is particularly important when considering concrete reinforcing steel corrosion.

Chloride Induced Corrosion of Reinforcing Steel in Concrete

Chlorides are an important consideration when examining reinforcing steel corrosion in concrete because they penetrate the passive layer around the rebar. The passive layer around rebar is a film created by the high pH (alkalinity) of concrete through which oxygen cannot penetrate. A prevailing theory is that chloride ions increase the solubility of the passive layer, causing it to give way at a threshold concentration[2]. Once the passive layer is penetrated, the corrosion action no longer needs chlorides to progress, and is typically self-sustaining, needing only the rebar, water, and oxygen to progress. The primary consideration after the passive layer is breached by chlorides then becomes the pore structure of the concrete along with the electrical resistivity that the pore structure provides[3].

[1] Singh, L.P., Karade, S.R., Bhattacharyya, S.K., Yousuf, M.M., & Ahalawat, S. (2013) "Beneficial role of nanosilica in cement based materials – a review," *Construction and Building Materials 47*, 1069-1077.
[2] Hussain, R.R. (2014) "Passive Layer Development and Corrosion of Steel in Concrete at the Nano-scale". *Journal of Civil & Environmental Engineering 4:e116*
[3] Neville, Adam (1995) "Chloride Attack of Reinforced Concrete: An Overview." *Materials and Structures 28, 63-70.*

SCP's Treatments Performance in Chloride Bulk Diffusion Testing

Chloride bulk diffusion involves ponding salt water on top of concrete and testing the chloride concentrations at various depths according to AASHTO T-259 or ASTM C1543. This information can then be input into calculations to produce an average diffusion coefficient (D) that can be utilized to predict the amount of time that it will take for chlorides to reach reinforcing steel and penetrate the passivation layer around it. These predictions are modeled with software such as Life 365 and others. If the diffusion coefficient can be reduced, years of time can be added to the period it takes for chlorides to reach the rebar, extending a structure's life expectancy. Three laboratories have tested SCP's performance in chloride bulk diffusion situations in conventional concrete. The results of these tests are presented in Table 1.

Table 1: Chloride Diffusion Reduction Percentage with SCP Treatment

Study	**W/cm Ratio of Concrete**	**Reduction in Chloride Diffusion Coeffecient (D), %**
Middle Tennessee State University	0.57	69
University of Tennessee at Chattanooga (average of 7 tests)[4]	0.45	69
Tennessee Department of Transportation	0.40	75
Florida Department of Transportation	0.40	55

To summarize, the reduction in chloride diffusion rate provided by SCP treatments has the potential to add years of time in the field before chlorides reach reinforcing steel.

[4] Collet, P., Rollins, A.B., Andres, V. (2016) "Concrete Porosity Reduction by Colloidal Silica Nano Technology" Conference Proceedings, CONSEC 16, Lecco, Italy.

SCP's Treatments Effects on Concrete with Inherent Chlorides

When examining results from the field testing, higher numbers in the surface resistivity and half-cell resistance rows indicate a greater resistance to chloride induced corrosion. In the row addressing corrosion potential, the resistance to chloride induced corrosion is increased as the result approaches zero. Further explanation of the threshold levels of each test are contained in Tables 2.1, 2.2, and 2.3.

Tables 2.1 and 2.2: Half Cell Potentials (left) and Half Cell Resistance (right)Thresholds

Half-Cell mV (Cu)	Corrosion Potential		Resistance (kOhm)	Support Corrosion
> -200	Low		≥ 50	Not Likely
-200 to -350	Uncertain		< 50	Yes
< -350	High			

Table 2.3: Surface Resistivity Thresholds

Surface Resistivity (kOhm/cm)	Corrosion Risk
≥ 20	Low
10 – 20	Low
5- 10	High
< 5	Very High

Two field studies with state DOTs have produced promising results on concrete containing inherent chlorides treated with SCP products. The first, with the Florida Department of Transportation (FDOT) involved four bridges. Half-cell corrosion potentials, surface resistivity, and water-soluble chloride content testing was performed, before and after treatment, with results as seen in Table 3.

Figures 2 and 3: Half-cell corrosion potential testing (left) and treating bridge deck with SCP (right)

Table 3: FDOT Bridge Case Studies Testing Results

	Wilcox Road Bridge	**Fred Howard Park Bridge**	**Palma Sola Boulevard Bridge**	**Blind Pass Bridge**
Surface Resistivity (kOhm/cm) Before/After	NA/425	NA/NA	102/245	176/228
Half-Cell Resistance (kOhm) Before/After	12/828	34/39	22/31	27/32
Corrosion Potential (mV) Before/After	-534/--	-59/-65	-563/-322	-223/-219
Chloride Content (% by weight of concrete) Before/After	--/--	--/--	0.0890/0.0605	0.0347/0.0203

The second field study was performed in conjunction with the Tennessee Department of Transportation (TDOT). A series of AASHTO Type III reinforced concrete I-beams had been manufactured by a prestressed/precast concrete manufacturer who had unknowingly used well water, contaminated with chlorides, as mixing water. The beam that had exhibited the highest levels of chloride concentration was selected for treatment with SCP products. Surface resistivity was performed before and after treatment.

Table 4: TDOT Bridge Beam Testing Results

	Before/After Treatment
Surface Resistivity (kOhm/cm)	31.44/43.31

To interpret what the changes in tested values for both the Florida and Tennessee DOT case studies, evaluation against commonly accepted industry threshold levels is useful for half-cell potentials, half-cell resistance, and surface resistivity.

Conclusion

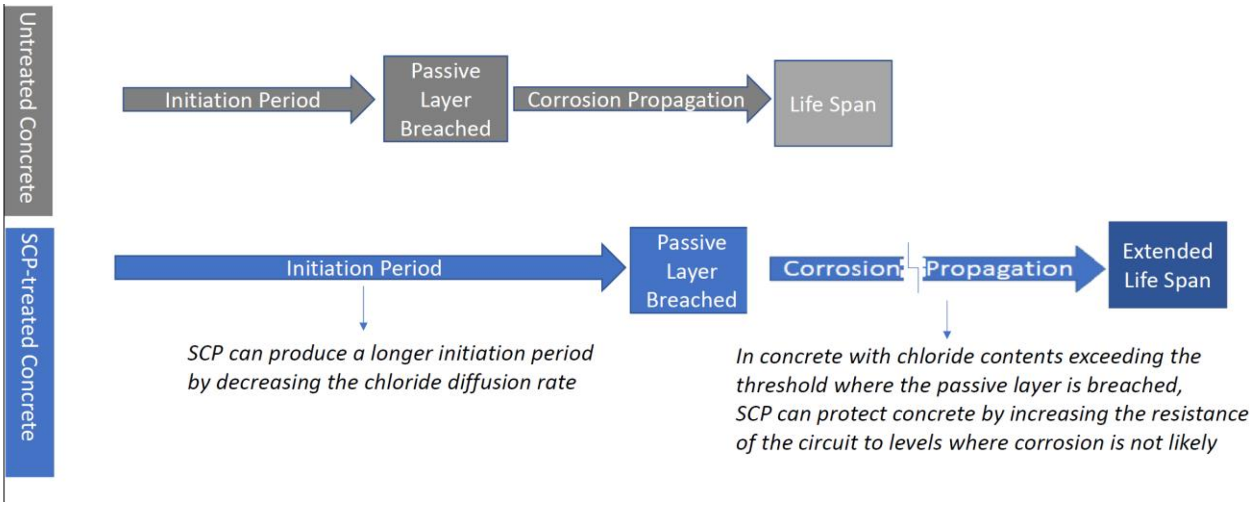


Figure 4: Describing the Effects of SCP on Reinforced Concrete Corrosion Cycle

SCP treatments are useful for combating corrosion of concrete reinforcing steel in several ways. First, SCP products can significantly slow the transmission of chlorides through the concrete, potentially extending the corrosion initiation period by years over untreated concrete. Second, SCP treatments can waterproof the concrete, reducing access of the corrosion reaction to water and significantly restricting oxygen availability. Next, SCP treatments can increase the electrical resistivity of the concrete to levels where corrosion is unlikely to occur. Finally, SCP products have demonstrated the ability to purge some of the available chlorides from the concrete.

In any corrosion mitigation project, SCP recommends testing levels of chlorides at various depths, and performing half-cell and surface resistivity measurements before and after treatment. Results should be evaluated to determine if treated results are consistent with requirements for reinforcing steel preservation for the project.

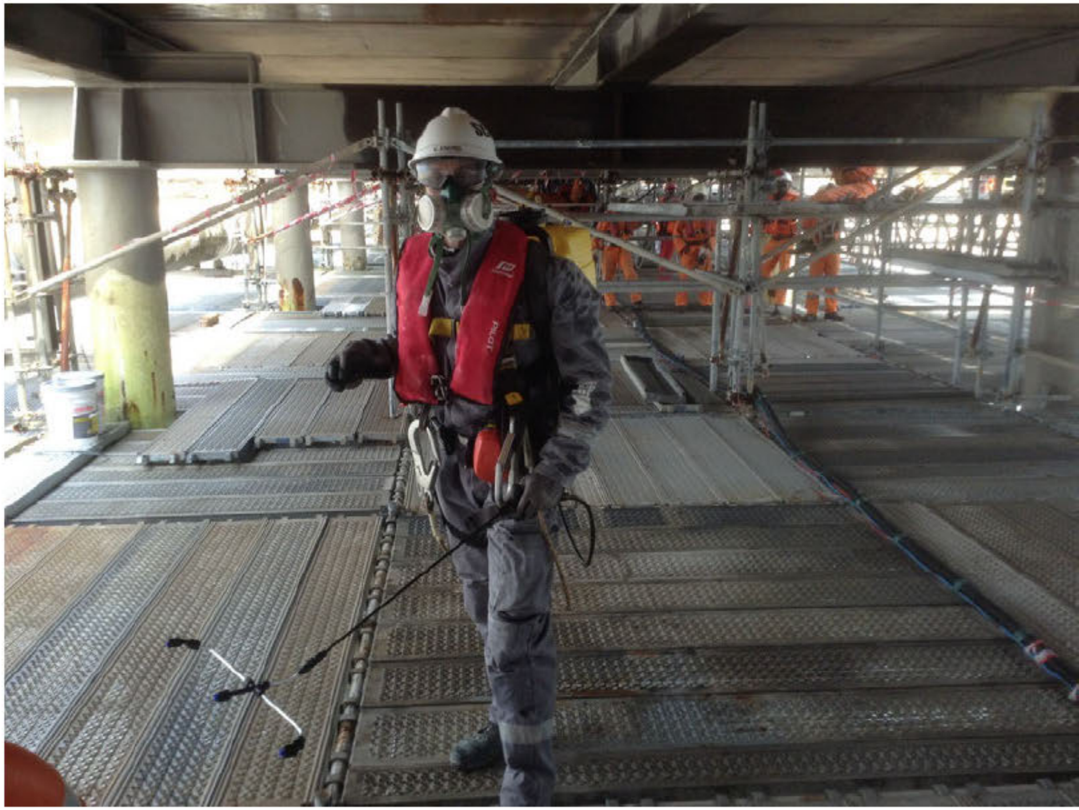
Djeno Wharf, Congo

Djeno Jetty, Congo Existing Concrete Remediation

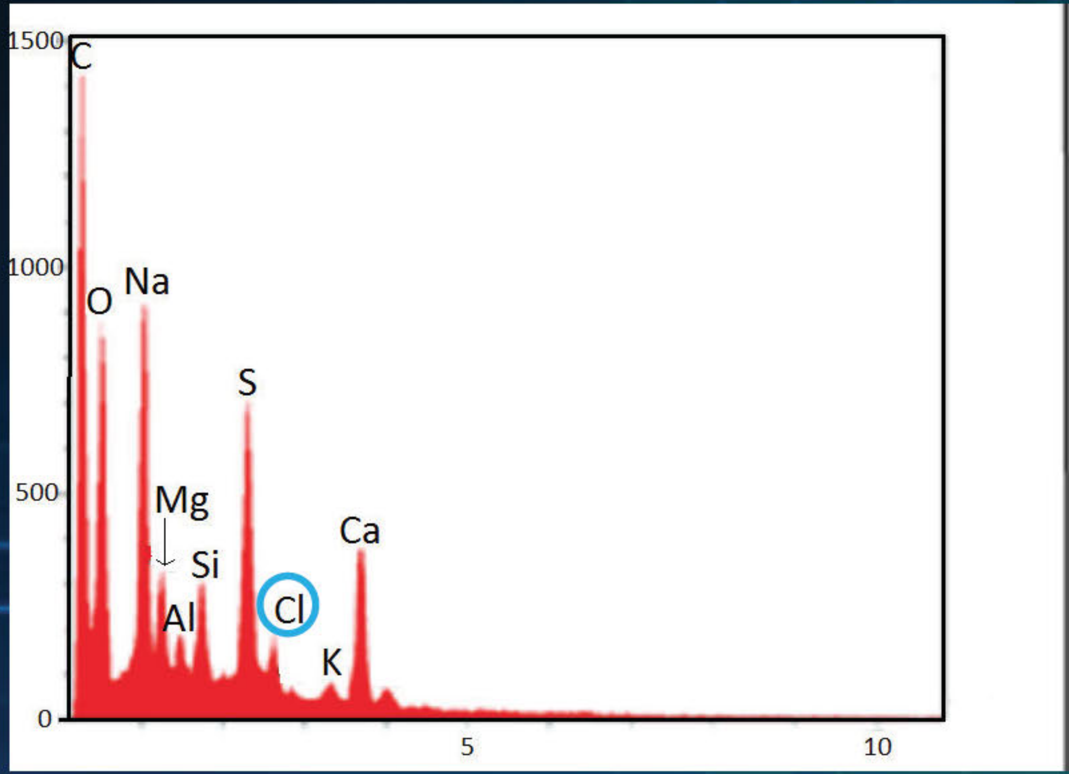
In-place concrete had durability concerns.

Concrete was treated from underneath in seawater splash zone.

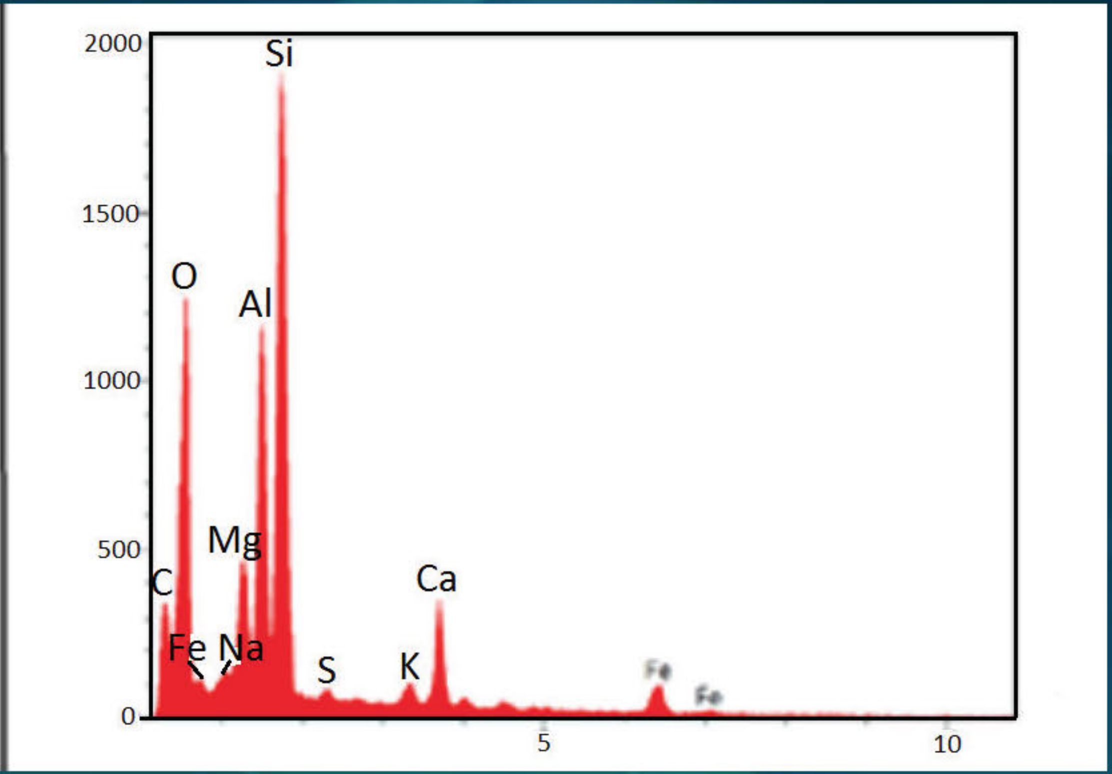
From cores extracted before and after treatment, it was determined that the structure's expected life cycle had been increased over 2x



Chloride Performance, Djeno Wharf 15mm Depth



Untreated



Treated

Subject: Checking in - test data P3 Marine
Date: Thursday, November 17, 2022 at 2:52:34 PM Eastern Standard Time
From: Brent Rollins
To: [redacted]

Hi [redacted]

Hope everything is going well for you guys. When we spoke on the [redacted] site I had mentioned sharing some information from the project I have going on in Dubai. Unfortunately I cannot send the report, but if you want to see it to verify, I can share the information via my screen in a Teams meeting. If there is any opportunity to meet for just a few minutes by Teams can you name a day and time? I'll make it work on my end.

I have included a summary of the information as follows. Please do not distribute outside your organization:

Laboratory of Record: Arab Center for Engineering Studies, Dubai, United Arab Emirates
Product Tested: Spray-Lock Concrete Protection P3 Marine
Project: Business Bay Towers, Dubai
Specimen type: Project Cores

Test Method: BS 1881: 2015 Part 124 Cl. 12.1. Chloride Content of Concrete (3 samples each depth, each condition)

Note: This test demonstrates the purging of non-chemically bound chlorides from the pore space.

	Avg. %, 0-25mm	Avg. % 25-50mm	Avg. % 50-75mm	Avg. % 75-100mm
Before	0.400	0.177	0.083	0.065
After P3 Marine	0.260	0.154	0.054	0.016
% Improvement	35%	13%	35%	75%

Test Method: ASTM C1202-19 Rapid Chloride Permeability (3 samples each condition)

Note: This test demonstrates an improvement of the pore structure as measured by electrical current passed.

	Average Coulombs passed in 6 hours
Before	469
After P3 Marine	327
% Improvement	30%

These results should not be interpreted as a guarantee of performance on your site with your concrete. However, as you can see from the coulomb ratings, this concrete started out as very good concrete. Concrete on your site, being older, likely will experience more benefits from P3 Marine application, but only a test area could say for sure. While on the site, we also discussed half-cell corrosion potentials and surface resistivity as methods to verify our products' performance. You mentioned you were familiar with half-cell, but not surface resistivity. See the link below for surface resistivity information:

https://www.fhwa.dot.gov/pavement/concrete/surfacetest.cfm

Please let me know if I can provide any additional information or if you would like to meet virtually for a few minutes.

All the best,

Brent

Brent Rollins
Vice President of Business Development
Spray-Lock Concrete Protection, LLC
M: +1 423.593.6674
www.concreteprotection.com

LinkedIn YouTube

Laboratory photograph of chloride purging on 8x8x24 in. beam

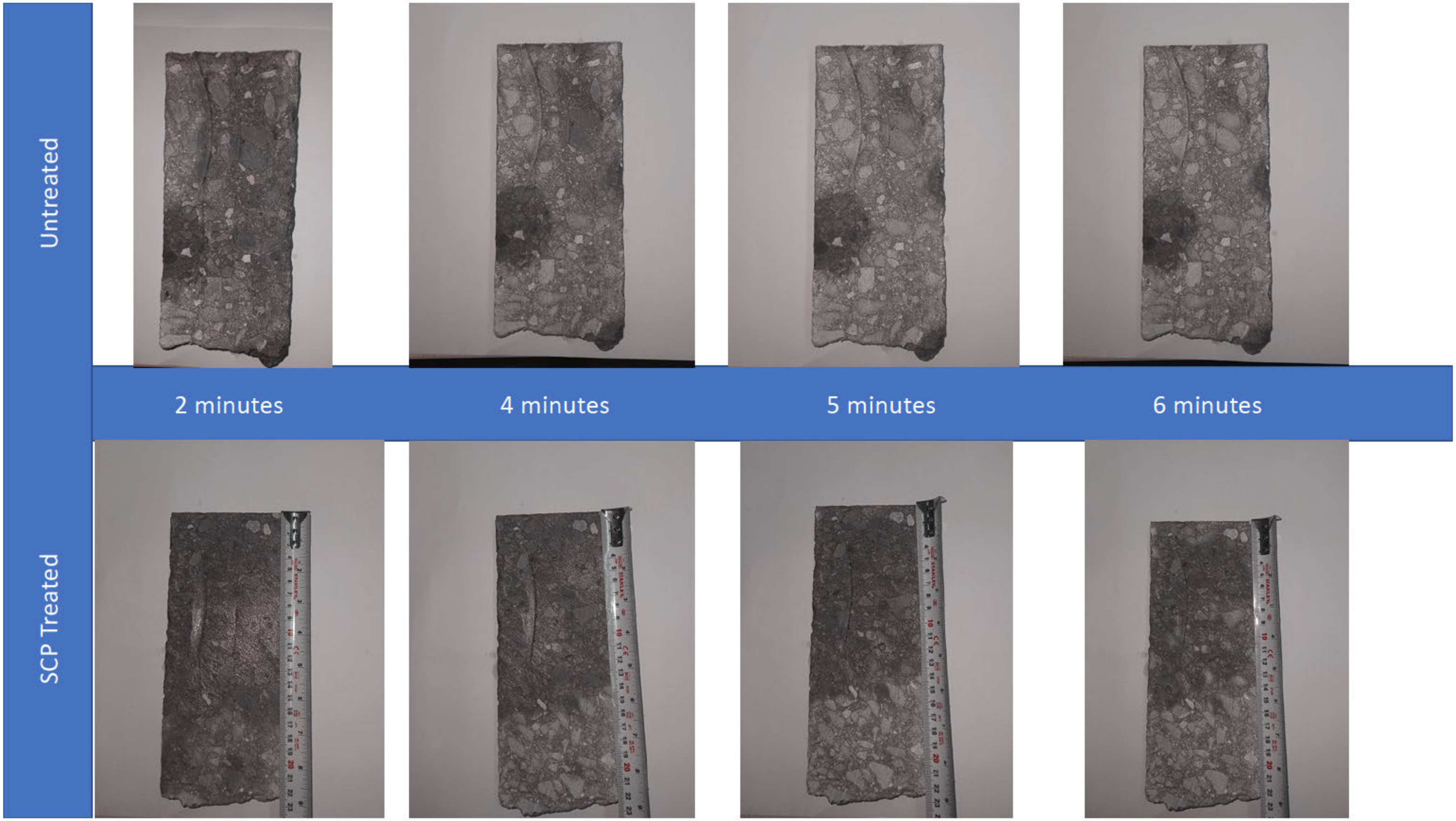
WATER POURED ALONG CORE SAMPLE

DRYING OUT AFTER 2 MINUTES

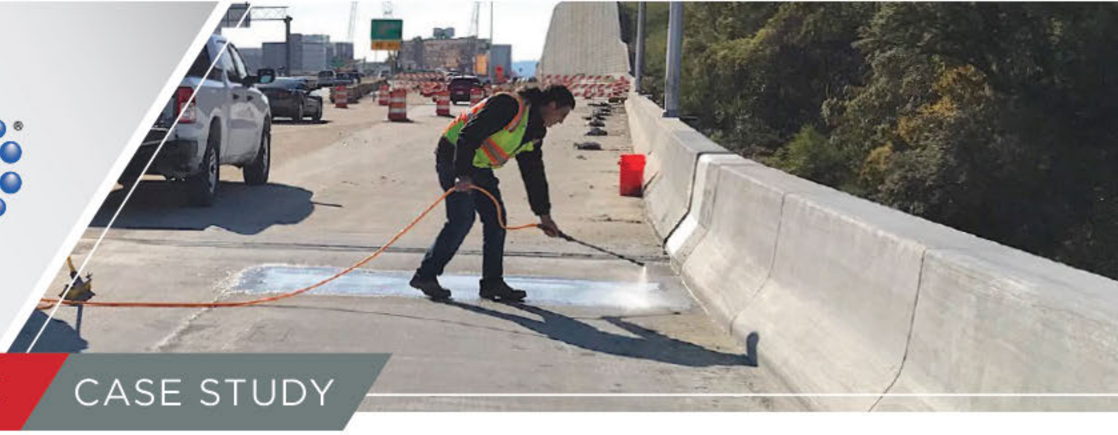
DRYING AFTER 3 MINUTES

DRIED AFTER 4 MINUTES SHOWS DEPTH OF PENETRATION BY WET SECTION

Depth of Penetration Determination from Business Bay Towers Project, Dubai, UAE



Spray-Lock® CONCRETE PROTECTION



TENNESSEE BRIDGE CASE STUDY

A Challenge Arises

A project in Chattanooga, Tennessee utilized lightweight aggregate concrete for a bridge-widening deck addition. Due to unexpected conditions with the concrete placement, questions arose regarding the in-place concrete's durability related to increased permeability. Testing indicated that the concrete met the designed compressive strength, but the engineering team wanted to explore options for treatments to improve permeability characteristics. The ready-mixed concrete supplier contacted Spray-Lock Concrete Protection (SCP) to see if our colloidal silica technology might offer a solution to the permeability issue.

SCP treatments have been used throughout the world to provide reduced permeability for increased concrete lifespan, even in the harshest exposure conditions. SCP submitted a work plan that included several options for assessing the effectiveness of the colloidal silica treatment. This work plan included the comparison of acceptable untreated areas to unacceptable areas both pre- and post-treatment. **The option to perform surface resistivity testing before and after treatment was selected, using an increase in surface resistivity of at least 25% to indicate a successful remediation.**

The Application

The bridge deck concrete was still relatively new (approximately 6 months), so cleaning of the surface was accomplished by pressure washing with water. The SCP infrastructure product was applied by a trained application crew from the ready-mix producer following SCP's standard application procedures for existing concrete structures.

Results *(shown below in table)*

Testing was performed by an independent consulting engineering firm from Atlanta, Georgia. Twenty (20) surface resistivity readings were made from each of the Northbound and Southbound traffic lanes. The concrete was then treated with SCP's recommended colloidal silica product formulated for transportation infrastructure concrete. Fourteen (14) days later, new readings were taken from the exact same locations as previously tested.

Discussion

The improvement to the surface resistivity results achieved by SCP treatment on this project is an indication that the pore structure of the concrete has been refined. This refinement will restrict the movement of water and chlorides from deicing chemicals, extending the expected lifespan of the bridge.
By using SCP technology, the contractor avoided costly repairs that may have otherwise been required. Because colloidal silica modifies the pore structure of the concrete itself, no re-application is needed for the life of the structure.

» For more information about how SCP can assist in improving the durability of concrete transportation infrastructure visit us at concreteprotection.com.

Surface Resistivity Results (kΩ/cm)

NORTHBOUND

TEST #	INITIAL	FINAL	TEST #	INITIAL	FINAL	TEST #	INITIAL	FINAL	TEST #	INITIAL	FINAL
1	41.3	50.0	6	43.6	47.8	11	47.5	55.1	16	58.1	60.0
2	42.2	60.5	7	36.4	46.9	12	43.1	63.3	17	37.6	54.5
3	33.8	51.9	8	35.9	47.6	13	40.3	46.6	18	34.7	56.0
4	37.0	53.8	9	42.0	47.2	14	50.8	64.6	19	42.6	49.2
5	47.5	61.3	10	32.0	54.2	15	40.3	64.3	20	51.1	62.7

Average Results

INITIAL	FINAL
41.9	54.9

INCREASED % 31.0%

SOUTHBOUND

TEST #	INITIAL	FINAL	TEST #	INITIAL	FINAL	TEST #	INITIAL	FINAL	TEST #	INITIAL	FINAL
1	21.0	43.9	6	25.5	47.1	11	48.5	60.4	16	34.0	47.5
2	22.7	40.0	7	24.7	45.6	12	38.0	52.4	17	37.0	72.6
3	25.5	40.4	8	26.3	35.7	13	41.6	62.1	18	24.0	60.5
4	28.5	36.9	9	35.0	40.2	14	40.0	59.3	19	28.0	53.8
5	24.4	46.2	10	26.4	41.7	15	32.7	56.6	20	29.0	51.4

Average Results

INITIAL	FINAL
30.6	49.7

INCREASED % 62.3%

Case Study_TNBridge DATE: 08.10.2020 REV: REL

Spray-Lock®
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TEST STUDY

The City of Kingsport, Tennessee has been curing their sidewalks and exterior concrete projects with SCP Technology for many years. For one of their new salt sheds, the city wanted to use the entrance slab as a means to evaluate the effectiveness of various SCP Technology options against corrosive salt attack. They wanted to see what an integral use of SCP products would provide in comparison to their current P3 Protect use, compared to their past use of ASTM C309 curing. The SCP treated sections, integral and spray-treated, would be placed side-by-side with standard concrete in order to have a true comparison.

The main slab and storage walls of the salt shed were cured with P3 Protect, as is the standard for city concrete. For the evaluations, the entrance slab was divided with construction joints into four equal sections, with one load of concrete pouring two sections, each receiving different curing products, allowing for four variation panels. The same base concrete mix design was used for the entire placement. The difference in the four panels is demonstrated in the photograph below. Salt was loaded into the structure less than 60 days after construction and treatment of the storage slab and walls.

After only one season of use, and less than 9 months after construction, the difference in surface appearance is strikingly clear. As one city official put it, **"Right there you can see the difference in the concrete. Whatever the tests show, that visible difference right there is the reason why we use SCP for curing our concrete. It just makes it better."**

SCP and the city continue to make regularly scheduled visits to the project to conduct both visual observations and surface resistivity readings in order to compare the long-term effects in this highly aggressive environment.

» Contact SCP for the premier concrete cure & protection!

- Standard concrete
- ASTM C309 Compound cure

- Standard concrete
- P3 Protect cure

- Standard concrete *with* SCP 1000 added at batch
- P3 Protect cure

- Standard concrete *with* SCP 1000 added at batch
- ASTM C309 Compound cure

MAIN SLAB AND WALLS
- Standard concrete *with* pan-troweled finish
- P3 Protect cure

Test Study_Salt Shed DATE: 06.15.2020 REV: REL

French Navy Dry Docks Project, Marseille

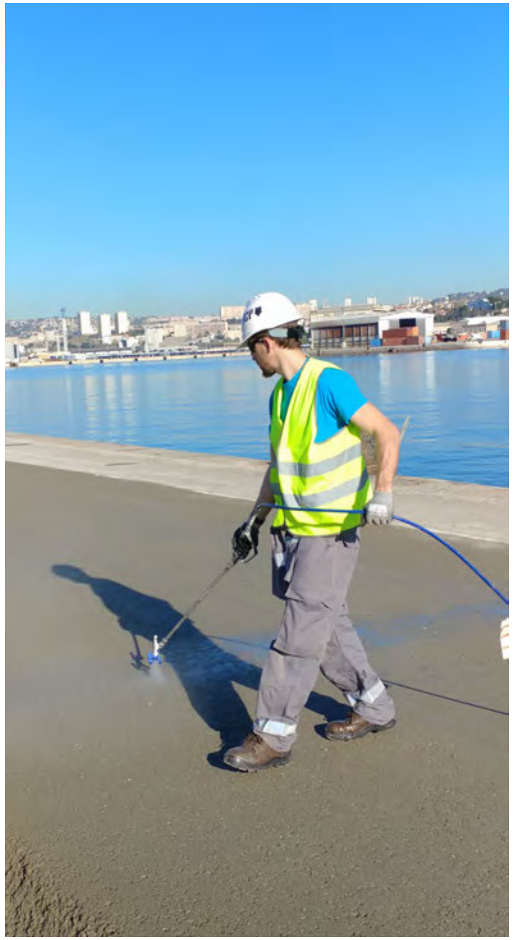
- Approximately 5,000 m2 applied in 2019
- Project successful, performance has prompted the planning of additional dry docks in 2021.

Spray-Lock®
CONCRETE PROTECTION

Duc d’Albe Port of Marseille, France

Additional Port of Marseille Project, this was a fuel offloading dock

Various other projects, Port of Marseille



Roller Compacted Concrete, Port of Marseille, France

During the construction process, port owners Anglo-American and LLX Logistica S.A. were concerned about the impact of the extreme marine environment on the pier structure. They identified Spray-Lock Concrete Protection® Technology [SCP] as the only solution to protect the concrete in this important port infrastructure investment.

Porto do Açu, Brazil

- Over 100,000 m2 treated with SCP products at one of the world's largest concrete piers.

Mentone Life Saving Club, Australia
SCP products selected as part of the repair regime for 50-year-old, salt-exposed concrete

USPI Surgery Center, West Palm Beach FL

SCP products selected to protect all concrete structures including parking garage at this hospital 0.5 km from the ocean.

Contractor: Turner Construction

Architect: E4H & Alfonso Hernandez Architect, LLC

Concrete Sub: Baker Concrete

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product name	:	P3 Mar ne
Substance name	:	Amorphous Co o da S ca

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/m xture	:	Concrete treatment

1.3. Details of the supplier of the safety data sheet

Spray Lock, Inc.
5959 Sha owford Road Su te 405
Chattanooga, TN 37421 USA
T 423 305 6151
nfo@spray ock.com

1.4. Emergency telephone number

Emergency number	:	+1 (423) 305 6151

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

GHS-US classification

Not c ass f ed

2.2. Label elements

GHS-US labelling

No abe ng app cab e

2.3. Other hazards

No add t ona nformat on ava ab e

2.4. Unknown acute toxicity (GHS US)

None.

SECTION 3: Composition/information on ingredients

3.1. Substance

Propr etary Formu a

Name	Product identifier	%
Silicon Dioxide	(CAS No) 7631-86-9	< 50
Water	(CAS No) 7732-18-5	> 70

3.2. Mixture

Th s m xture does not conta n any substances to be ment oned accord ng to Hazard Commun cat on Standard (CFR29 1910.1200) HazCom 2012

SECTION 4: First aid measures

4.1. Description of first aid measures

F rst a d measures after nha at on	:	Move the affected person away from the contam nated area and nto the fresh a r.
F rst a d measures after sk n contact	:	In case of contact, mmed ate y f ush sk n w th p enty of water. Remove contam nated c oth ng and shoes. Wash c oth ng before reuse. Ca a phys c an f rr tat on deve ops and pers sts.
F rst a d measures after eye contact	:	In case of contact, mmed ate y f ush eyes w th p enty of water. If easy to do, remove contact enses, f worn.
F rst a d measures after ngest on	:	If swa owed, do NOT nduce vom t ng un ess d rected to do so by med ca personne . Never g ve anyth ng by mouth to an unconsc ous person. Get med ca adv ce/attent on.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/ njur es after nha at on	:	Not a norma route of exposure.
Symptoms/ njur es after sk n contact	:	May cause sk n rr tat on.
Symptoms/ njur es after eye contact	:	May cause eye rr tat on.
Symptoms/ njur es after ngest on	:	Not a norma route of exposure.

4.3. Indication of any immediate medical attention and special treatment needed

Symptoms may not appear mmed ate y. In case of acc dent or f you fee unwe , seek med ca adv ce mmed ate y (show the abe or SDS where poss b e).

SECTION 5: Firefighting measures

5.1. Extinguishing media

Su tab e ext ngu sh ng med a	:	Powder, water spray, foam, carbon d ox de.
Unsu tab e ext ngu sh ng med a	:	None known.

5.2. Special hazards arising from the substance or mixture

F re hazard	:	Not combust b e.

5.3. Advice for firefighters

Protect on dur ng f ref ght ng	:	Keep upw nd of f re. Wear fu f re f ght ng turn out gear (fu Bunker gear) and resp ratory protect on (SCBA).

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Genera measures	:	Use persona protect on recommended n Sect on 8. Keep unnecessary personne away from the re ease.

6.2. Methods and material for containment and cleaning up

For conta nment	:	Stop eak, f poss b e w thout r sk.
Methods for c ean ng up	:	D ute sp d rect y w th p enty of water and dra n to sewer.

6.3. Reference to other sections

See sect on 8 for further nformat on on protect ve c oth ng and equ pment and sect on 13 for adv ce on waste d sposa .

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precaut ons for safe hand ng	:	Hand e n accordance w th good ndustr a hyg ene and safety pract ce. When us ng do not eat, dr nk or smoke.
Hyg ene measures	:	Wash hands before eat ng, dr nk ng, or smok ng.

7.2. Conditions for safe storage, including any incompatibilities

Storage cond t ons	:	Keep out of the reach of ch dren. Keep conta ner t ght y c osed. Protect from sun ght. Do not freeze. Store at temperatures between 5 °C (40 °F) and 38 °C (100 °F).

7.3. Specific end use(s)

Not ava ab e.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

None

8.2. Exposure controls

Appropr ate eng neer ng contro s	:	Use vent at on adequate to keep exposures (a rborne eve s of dust, fume, vapor, etc.) be ow recommended exposure m ts.
Persona protect ve equ pment	:	Avo d a unnecessary exposure.
Hand protect on	:	None necessary under norma cond t ons of use. Wear g oves f hand ng arge quant t es.
Eye protect on	:	Wear eye protect on.
Sk n and body protect on	:	Wear su tab e protect ve c oth ng.
Resp ratory protect on	:	In case of nadequate vent at on wear resp ratory protect on.
Env ronmenta exposure contro s	:	Ma nta n eve s be ow Commun ty env ronmenta protect on thresho ds.
Other nformat on	:	Hand e accord ng to estab shed ndustr a hyg ene and safety pract ces.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Phys ca state	:	L qu d
Appearance	:	Trans ucent
Co or	:	C ear
Odor	:	Odor ess
Odor thresho d	:	Not app cab e
pH	:	11.2 11.5
Me t ng po nt	:	0 °C (32 °F): Water / 1,713 °C (3,115 °F) Amorphous S con D ox de

Freez ng po nt	:	0 °C (32 °F): Water
Bo ng po nt	:	100 °C (212 °F): Water
F ash po nt	:	Not app cab e
Re at ve evaporat on rate (buty acetate=1)	:	0.3
F ammab ty (so d, gas)	:	Not f ammab e
Exp os ve m ts	:	Not app cab e
Exp os ve propert es	:	Not app cab e
Ox d s ng propert es	:	Not app cab e
Vapor pressure	:	3.1690 kPa @ 25°C (0.0313 atm @ 77°F)
Re at ve dens ty	:	1.10
Re at ve vapor dens ty at 20 °C	:	1.73 x 10^{-5}
So ub ty	:	Not app cab e
Part t on coeff c ent: n octano /water	:	Not app cab e
Auto gn t on temperature	:	Not app cab e
Decompos t on temperature	:	> 2,000 °C
V scos ty, k nemat c	:	24 cSt @ 25 °C (77 °F)
V scos ty, dynam c	:	26 cP @ 25 °C (77 °F)

9.2. Other information

No add t ona nformat on ava ab e

SECTION 10: Stability and reactivity

10.1. Reactivity

No dangerous react on known under cond t ons of norma use.

10.2. Chemical stability

Stab e under norma storage cond t ons.

10.3. Possibility of hazardous reactions

No dangerous react on known under cond t ons of norma use.

10.4. Conditions to avoid

Heat. Incompat b e mater a s.

10.5. Incompatible materials

Ac ds.

10.6. Hazardous decomposition products

Not app cab e.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute tox c ty : Not c ass f ed.

P^3 Marine	
LD50 ora rat	No data ava ab e
LD50 derma rabb t	No data ava ab e
LC50 nha at on rat	No data ava ab e

Sk n corros on/ rr tat on	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Ser ous eye damage/ rr tat on	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Resp ratory or sk n sens t sat on	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Germ ce mutagen c ty	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Carc nogen c ty	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Reproduct ve tox c ty	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Spec f c target organ tox c ty (s ng e exposure)	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Spec f c target organ tox c ty (repeated exposure)	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.
Asp rat on hazard	:	Based on ava ab e data, the c ass f cat on cr ter a are not met.

Symptoms/ njur es after nha at on	: Not a norma route of exposure.
Symptoms/ njur es after sk n contact	: May cause sk n rr tat on.
Symptoms/ njur es after eye contact	: May cause eye rr tat on.
Symptoms/ njur es after ngest on	: Not a norma route of exposure.

SECTION 12: Ecological information

12.1. Toxicity

Eco ogy genera : No known s gn f cant effects or cr t ca hazards.

12.2. Persistence and degradability

P3 Marine	
Pers stence and degradab ty	Not estab shed.

12.3. Bioaccumulative potential

P3 Marine	
B oaccumu at ve potent a	Not estab shed.

12.4. Mobility in soil

No nformat on ava ab e

12.5. Other adverse effects

No nformat on ava ab e

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste d sposa recommendat ons : Th s mater a must be d sposed of n accordance w th a oca , state, prov nc a , and federa regu at ons. Th s mater a s not subject to RCRA, EPCRA, CERCLA regu at ons.

SECTION 14: Transport information

Department of Transportation (DOT)

Not regu ated for transport

Additional information

Other nformat on	: No nformat on ava ab e.
Spec a transport precaut ons	: Do not hand e unt a safety precaut ons have been read and understood.

SECTION 15: Regulatory information

15.1. US Federal regulations

A components of th s product are sted, or exc uded from st ng, on the Un ted States Env ronmenta Protect on Agency Tox c Substances Contro Act (TSCA) nventory

15.2. US State regulations

P3 Marine	
State or oca regu at ons	Th s product does not conta n a chem ca known to the State of Ca forn a to cause cancer, b rth defects or other reproduct ve harm.

SECTION 16: Other information

Date of ssue	: 03/18/2020
Rev s on date	: 05/05/2020
Other nformat on	: None.

Disclaimer: We believe the statements, technical information and recommendations contained herein are reliable, but they are given without warranty or guarantee of any kind. The information contained in this document applies to this specific material as supplied. It may not be valid for this material if it is used in combination with any other materials. It is the user s responsibility to satisfy oneself as to the suitability and completeness of this information for the user s own particular use.

31-SDS-P3 Marine
Date 05/05/2020
Rev 1 1

NOTE TO SPECIFIER: Be sure to obtain the latest version of this Guide Specification.

This Guide Specification is not a completed document ready for use. It must be edited (i.e., deleting, adding, or modifying text) as required to suit project requirements.

The design professional and the contracting parties of the Contract Documents are responsible for the accuracy of issued project specifications, including use of this SCP™ Guide Specification.

Contact SCP™ for instructions for other applications not included in this specification.

SCP™ (SPRAY-LOCK CONCRETE PROTECTION™) SHALL NOT BE LIABLE FOR DAMAGES ARISING OUT OF THE USE OF THIS GUIDE

CSI 3-PART SHORT-FORM GUIDE SPECIFICATION

EDIT TO SUIT PROJECT REQUIREMENTS

SECTION

SCP™ SPRAY-APPLIED COLLOIDAL SILICA CONCRETE TREATMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes SCP™ spray-applied, penetrating, colloidal silica concrete treatments and substrate protection, applied after finishing for new and existing concrete for use in areas where the concrete member is exposed to migration and diffusion of chlorides from saltwater, splash zones, potential liquid contaminants under hydrostatic pressure, regular and consistent exposure to detrimental conditions, or other similar severe sources of attack mechanisms.

1.2 PRE-POUR/ PREINSTALLATION MEETINGS

A. Pre-pour/ preinstallation meeting: SCP™ personnel or approved representative should be in attendance, in-person or by phone, at the pre-pour/ preinstallation meeting for concrete placement to discuss the requirements for concrete member preparation and product application.

1.3 SUBMITTALS

A. Product Data: For each type of product.

1.4 QUALITY ASSURANCE

A. Material Requirements: Concrete mixes need to be Portland cement based and designed in accordance with ACI and ASTM requirements.

B. Manufacturer Qualifications: ISO 9001 Certified Manufacturer with a minimum 5 years' experience and capable of providing field service representation.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Delivery, storage, and handling shall be according to the manufacturer’s written recommendations, industry guidelines, and/or Division 01 requirements whichever is more stringent.

1.6 FIELD CONDITIONS

A. Environmental Requirements per manufacturer’s written recommendations, Division 01, and as follows:
   1. Allow surfaces to attain a temperature of 35 deg F (1.7 deg C) and rising before proceeding with product application.
   2. Product should not be allowed to freeze.
   3. Protect application surfaces during periods of exposure to high winds.
   4. Surfaces to be treated should not be frozen or have frost on them. In addition, standing water should be removed prior to treatment.
   5. Surfaces over 90 deg F and Direct Sunlight Conditions: Spray a fine mist of water on the surface before the application of SCP™ treatment to help alleviate premature chemical reaction and/or drying from taking place prior to achieving maximum penetration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. SCP™ Spray-Applied Penetrating Colloidal Silica Concrete Treatment Performance:
   1. ASTM C 1556 Standard Test Method for Determining the Apparent Chloride Diffusion Coefficient of Cementitious Mixtures by Bulk Diffusion: Treated, normal strength concrete typically provides at least a 30% reduction of chloride diffusion from untreated concrete.
   2. NT 492 nordtest method Concrete, Mortar and Cement-Based Repair Materials: Chloride Migration Coefficient From Non-Steady-State Migration Experiments: Treated, normal strength concrete typically provides at least a 20% reduction of chloride migration from untreated concrete.
   3. EN 12390-8 Testing hardened concrete: Depth of penetration of water under pressure: Treated, normal strength concrete a typically provides at least a 70% reduction of penetration from untreated concrete.
   4. ASTM C 1803 Standard Guide for Abrasion Resistance of Mortar Surfaces Using a Rotary Platform Abraser: Treated, normal strength concrete typically provides at least a 40% reduction in abrasion loss from untreated concrete.

NOTE TO SPECIFIER: Retain or revise paragraph and subparagraphs below for USGBC LEED v4 requirements.

B. Low-Emitting Materials:
   1. General Emissions Evaluation: Building products shall be tested and determined compliant according to California Department of Public Health (CDPH) Standard Method v1.1–2010, using the applicable exposure scenario.

2.2 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide spray-applied products by Spray-Lock Concrete Protection, LLC, 5959 Shallowford Road, Suite 405, Chattanooga, TN 37421; (office) 423.305.6151 / (fax) 423.305.6150; www.concreteprotection.com

B. SCP™ penetrating colloidal silica concrete treatments shall conform to the information provided in the most current product data sheet supplied by Spray-Lock Concrete Protection.

2.3 ACCESSORIES

A. Large Surface Areas and/or Volumes: Low-pressure, high-volume sprayer less than 100 psi (0.69 MPa), or medium-pressure airless sprayer less than 500 psi (3.4 MPa). Please refer to the manufacturers Product Data Sheet for more information on sprayer requirements and additional equipment.

B. Small to Medium Surface Areas and/or Volumes: Pump or backpack sprayer for areas under 1000 sq ft (9.3 sq m), or sprayers indicated for large surface areas above.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prepare according to SCP™'s written instructions.

3.2 APPLICATION

A. Apply using the SCP™'s written instructions.

END OF SECTION