Concrete Moisture Solutions manufactures concrete admixtures to improve your project's performance. Our flagship product, **Barrier One**, is a "Porosity Inhibiting Admixture" (PIA) which increases the Calcium Silicate Hydrate (C-S-H) in mix designs without the use of sodium silicates. Barrier One renders the concrete non-hygroscopic (impermeable). When used in concrete, there are no bonding issues with non-porous adhesives, flooring and coatings.

Barrier One has been independently tested and certified as a Porosity Inhibiting Admixture, a shrinkage reducer, a corrosion inhibitor, Chloride Ion Penetration inhibitor, and an Alkali Silicate Reaction (ASR) reducer. Additionally, as demonstrated in testing, Barrier One increases concrete strength (amount varies per mix design). Barrier One can be utilized anywhere new concrete finishes may be affected by moisture vapor; benefiting all floorings, epoxies, urethane coatings and roof membranes. In addition to interior floor slabs, Barrier One's PIA has been used in water treatment plants, secondary containment units, tunnels, airport runways, underground vaults, foundations, parking structures, swimming pools, precast concrete components, and roof decks.

Concrete Moisture Solutions' products include "Barrier One" (Porosity Inhibiting Admixture), "CSXtreme" (an admixture for exterior use), and "CPS" (a sodium silicate-based Moisture Vapor Reducing (MVRA) product for budget constrained projects). These admixtures are used to produce high performance concrete mixes that are called upon to perform in all conditions. Concrete Moisture Solutions maintains a strong commitment to the environment and sustainability and continually conducts scientific research to enhance its products; incorporating the latest technology available to meet customer needs. Please see more at http://barrierone.com/ and http://cpsadmix.com/.

SECTION 03 05 10 – CONCRETE POROSITY INHIBITING ADMIXTURE ("PIA")

Revise this Section by deleting and inserting text to meet Project-specific requirements.

Verify that Section titles referenced in this Section are correct for this Project's Specifications; Section titles may have changed.

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The Contractor, Subcontractors, and/or suppliers providing goods and services referenced in or related to this Section shall also be bound by the Related Documents identified in Division 03 Section "Summary."

1.2 SUMMARY

A. Section includes:

1. High performance, concrete Porosity Inhibiting Admixture (PIA) for all new concrete slabs, including slab-on-grade, elevated slabs, and stair treads and landings.

B. Related Sections:

1. Division 01 Section : Sustainable Design Requirements".
2. Division 03 Section "Cast-in-Place Concrete" for ASTM E 1745 - 17 vapor retarders.
3. Division 07 Waterproofing Sections – for horizontal & vertical concrete and roofing applications in which waterproofing is to be applied
4. Division 09 Flooring Sections for all moisture sensitive flooring materials installed over concrete slabs with "PIA". using nonporous adhesives.

1.3 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, ground granulated blast-furnace slag, and silica fume; subject to compliance with requirements.

1.4 REFERENCES

Industry Guidelines:

A. American Concrete Institute (ACI):
1. ACI 306R-10 Guide to Cold Weather Concreting
2. ACI 305R-10 Guide to Hot Weather Concreting
3. ACI 302.2R-06 Guide for Concrete Slabs that receive Moisture Sensitive Flooring
4. ACI 308R-16 Guide to Curing Concrete
5. ACI 302.1R- 96 Guide for Concrete Floor Slab Construction (Topping Depth)
6. ACI 503R-93& 98 Use of Epoxy Compounds with Concrete

Procedural Testing Methods:

B. American Society for Testing and Materials International (ASTM)
1. ASTM D7234-05 Pull Off Adhesion Strength of Coatings on Concrete….
2. ASTM C 494/C 494M-08a Chemical Admixtures for Concrete Type S.
3. ASTM C 157/C 157M – 08 Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
4. ASTM C1202/AASHTO T277: Rapid Chloride Permeability Test

5. ASTM G 109: Standard Test Method for Determining Effects of Chemical Admixtures on Corrosion of Embedded Steel Reinforcement in Concrete Exposed to Chloride Environments
6. ASTM C 1260: Standard Test Method for Potential Alkali Reactivity of Aggregates
7. ASTM E 1745 - 17: Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
8. ASTM E 1643: Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.
9. ASTM F 710-11 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring.
10. ASTM D 5084: Standard Test Methods for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
11. U.S. Army Corp of Engineers CRD-C48-92 Standard Test Method for Permeability of Concrete

1.5 SUBMITTALS

A. Product Data: Manufacturer's printed data.

B. Independent product test reports performed by a qualified testing agency evidencing compliance and/or certification with the US Army Corps of Engineers.

C. Sample copy of copyrighted "Life of the Concrete" warranty.

D. Sample copy of copyrighted adhesion guarantee.

E. Sample copy of copyrighted moisture letter.

F. HPD Health Product Declaration (Independently verified).

G. Provide copy of USA based insurance coverage to confirm warranty enforcement and legitimacy upon request.

H. Safety Data Sheet. (SDS)

I. National reference list of 2800+ standard "Life of the Concrete" warranted projects; all of which had ASTM 5084 testing and/or Army Corps of Engineers CRD C48-92 performed.

1.6 QUALITY ASSURANCE

A. Admixture Manufacturer Qualifications: A manufacturer with not less than Ten (10) years' experience in the actual manufacturing of concrete enhancement technology admixtures. Selected product manufacturer must have certification of compliance with ASTM C494 /C494M testing protocols from an independent AASHTO / Corps of Engineers approved laboratory. A manufactured product is a stand-alone source or entity that manufacturers the porosity inhibiting admixture "PIA" and its components primarily in house. Manufacturer must have legitimate USA manufacturing presence to assure legitimate warranty enforcement. Manufacturer will provide an on-site, contracted independent ACI certified technical representative capable of randomly sampling each day's placement. One random cylinder per day's concrete placement should be independently tested per ASTM 5084 and / or Army Corp of Engineers CRD C48-92 testing criteria.

B. Pre-installation Conference

1. Verify all parties review "PIA" project quality control procedures, concrete mix designs and procedures for ensuring quality of concrete materials. Those required to participate (attend in person, conference call, or to provide electronic review of documents) include:

    1. General Contractor
    2. Independent testing agency responsible for PSI testing of concrete design mixtures, sampling and testing.
    3. Ready-mix concrete manufacturer.
    4. Concrete subcontractor
    5. PIA manufacturer.

C. Ready Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed

concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

D. Porosity Inhibiting Admixture Collection Agent / Representative Qualifications

1. Daily sample collections shall be taken by an ACI Concrete Field Testing Technician, Grade 1, or equivalent, on behalf and at cost of the PIA manufacturer.

E. Slab Moisture Testing and Evaluation: Personnel performing laboratory tests shall be certified in the conduct of ASTM D5084 and/or Army Corp of Engineers CRD C48-92 under the supervision of a licensed geotechnical engineer. The determination as to whether the concrete slab is prepared to receive flooring, coatings, roofing, etc. rests with the "PIA" manufacturer in conjunction with adherence and compliance with manufacture's installation guidelines.

F. Source Limitations: Obtain PIA from the same manufacturer.

G. ACI Publications: For slabs to receive moisture sensitive coatings or material, comply with the following unless modified by requirements in the Contract Documents:

1. ACI 302.2R-06, "Guide for Concrete Slabs that Receive Moisture-Sensitive Flooring".

2. ACI 308-16 "Guide to External Curing of Concrete" Ref. Section 4.1.4 "Moisture Sensitive Floors"

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver "PIA" in manufacturer's original, undamaged containers.

B. Store "PIA" protected from exposure to harmful weather conditions and in a temperature-controlled area above 36 degrees.

C. Do not allow product to freeze. Should product freeze, immediately contact the "PIA" manufacturer for further instructions.

1.8 WARRANTY REQUIREMENTS:

A. Porosity Inhibiting Admixture ("PIA"):

1. "PIA" must be installed according to, and in compliance with, the manufacturer's published data sheet, including:

1. Dosing instructions.
2. Onsite independent representation and sampling requirements.
3. Use of an ASTM E 1745 vapor retarder installed following ASTM E 1643 and ACI 303.2R -06 and ASTM F710 guidelines; elevated slabs to receive flooring do not require a vapor retarder.
4. The design and specifications for roof deck assemblies, to include but not limited to, the use of air barriers and/or vapor retarders is the sole responsibility of the design professional and is excluded from this warranty as are any costs incurred due to roofing overburden.
5. Curing for all moisture sensitive products should be in compliance with ACI 308-16 "Guide to External Curing of Concrete" Section 4.1.4 "Moisture Sensitive Floors"

2. Manufacturer's Standard Warranty shall include:

1. Term: Life of the Concrete Warranty.
2. Repair and/or removal of failed flooring or roofing.
3. Placement of a topical moisture remediation system.
4. Replacement of flooring/roofing materials like original installed to include material and labor.
5. Sodium Silicate Free Concrete Enhancement Technology (CET) known as a Porosity Inhibiting Admixture "PIA"

3. Manufacturer's Adhesion Warranty shall include:

1. Warranty term to match that of the adhesive and/or primer manufacturer's material defect warranty.
2. Issued upon "PIA" manufacturer's acceptance of field adhesive bond testing which followed flooring / adhesive manufacturer guidelines and requirements noted in ASTM F-710 for installation on a nonporous surface.

4. Moisture Letter: "PIA" Manufacturer shall provide a standard moisture letter indicating warrantability up to 100% RH per qualified ASTM 2170 Insitu Probe testing and up 25lbs for ASTM 1869 CaCl testing.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis-of-Design "Barrier One Admixture" as distributed by Concrete Moisture Solutions "CMS"; 640 Garden Commerce Parkway, Winter Garden, Florida 34787. Phone: 877.224.5850 Fax: 866 594 3490. Email: info@barrierone.com

B. Subject to compliance with the requirements of this section, under provisions of Section 01 60 00, substitutions may be considered if they are demonstrated to be equal through qualified independent testing and processes demonstrated and certified to be free of sodium silicate. Failure to provide a product that meets or exceeds the "PIA's" minimum warranty requirements of Part I and the "PIA" field quality control requirements of Part 3 will result in all subsequent testing and slab remediation costs being borne by the Ready-Mix supplier, Concrete Contractor and General Contractor. Sodium Silicate MVRAs are not to be considered as equal to the newest concrete enhancement technologies known as porosity inhibiting admixtures or "PIA". The responsibility and issuance of warranties for such a substitution will be borne by the project field parties submitting such a substitution.

2.2 MATERIALS

A. "PIA" for interior slabs (on ground and elevated) and structural roof deck construction shall be a non-toxic, liquid admixture that is free of volatile organic compounds (VOC) and sodium silicatesThis PIA shall create a natural chemical reaction forming a permanent barrier (capillary break) that is integral to the concrete, insoluble, and irremovable.

1.	Hydraulic conductivity:	Project specific maximum of 6.0 E-8 cm/s per ASTM D5084 as tested daily
2.	Toxicity:	None
3.	Odor:	None
4.	Flammability:	None
5.	VOC levels:	zero
6.	Solvent:	water
7.	Freeze Temp:	32 degrees Fahrenheit (0^0 C) (store above 36^0 F (2.3^0 C))
8.	Acid resistance:	Excellent
9.	Hazardous vapors:	None
10.	Installation:	All concrete
11.	Capillary break:	Calcium Silicate Hydrate
12.	pH:	11.3
13.	weight:	10.3 lbs/gal (net)
14.	Integral biocide to inhibit growth of mold and bacteria	
15.	Reactive Silicates:	Contains no sodium silicate

2.3 RELATED MATERIALS

A. Sheet Vapor Retarder: ASTM E 1745 -17 compliant material, minimum Class A or B conforming to Table 1. Include manufacturer's recommended adhesive or pressure-sensitive tape, foundation and penetration detailing per both ASTM 1643 and manufacturer's detailing and installation and application instruction.

1. Products: Subject to compliance with requirements, [available products that may be incorporated into the Work may be manufactured by, but are not limited to, the following]:

1. Perminator, Inc.
2. Meadows, W. R., Inc.
3. Raven Industries Inc.
4. Reef Industries, Inc.
5. Stego

2. It is the responsibility of the vapor retarder manufacturer to show compliance with the most current version of ASTM E1745 - 17.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Add "PIA" in accordance with manufacturer's printed data sheet instructions: For mix designs ranging from 0.31 to 0.52 w/cm, dosages at 14 ounces per 100 pounds (414ml/45kg) of total cementitious materials. Remove an equal amount of water from the mix. Add separately from other admixtures at the tail end of the load. Mix designs below 0.31 and above 0.52 may require adjustment and consultation with "PIA" manufacturer and is required prior to their use.

1. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete with "PIA" according to ASTM C 94/C 94M; furnish batch ticket information showing dosage of "PIA".
2. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94/C 94M. Add the "PIA" to where it makes direct contact with the ready-mix material and then rotate drum of batch truck on high for at least seven minutes prior to discharge.

B. Freshening onsite with held back mix water is acceptable so long as the practice is in accordance with published ACI guidelines and does not exceed the original water to cementitious material ratio or instructions of the structural engineer and those reviewed by the "PIA: manufacturer.

C. Use of water reducing admixtures is recommended to achieve slumps greater than 4" (102mm).

D. Use of other admixtures in the same batch as "PIA" is acceptable so long as each admixture is added separately.

E. Typical National Ready Mix delivered pricing for Barrier One is in the range of $45 - $60 per cubic yard dependent upon the mix design approved and utilized. Anticipated Bid prices should be reflective of these national averages.

F. The inclusion of a shrink reducing admixture (SRA) is not acceptable.

G. The addition of a crystalline growth admixture is not acceptable.

H. In Cold-Weather Placement: Comply with ACI 306.1.

I. In Hot-Weather Placement: Comply with ACI 305.

3.2 CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 305 for hot-weather protection during curing. Also consult ACI 308-16 Section 4.1.4 and ACI 302.2 R regarding "Moisture Sensitive Floors"

B. Cure concrete slabs to receive moisture sensitive coatings according to ACI 302.2R-06, by one or a combination of the following methods:

1. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure concrete containing "PIA" for not less than 24 hours, longer if ambient conditions are hot, windy, and sunny or subject to periods of very low humidity. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
2. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after

initial application. Maintain continuity of coating and repair damage during curing period.

1. Removal: After curing period has elapsed, mechanically remove curing compound prior to the installation of final flooring material in accordance with ASTM F-710.

2. Do not chemically remove.

3.3 FIELD QUALITY CONTROL

A. Testing and Inspecting: The manufacturer of the "PIA" will, at their expense, contract with a qualified independent agency to obtain project specific sample cylinders and independent certified laboratories for subsequent testing per ASTM D5084 and preparation of test reports per each daily concrete placement.

B. Testing of Slabs Containing "PIA":

1. The "PIA" manufacturer will perform all daily concrete placement internal moisture ASTM 5084 and/or Army Corp of Engineers CRD C48-92 testing in accordance with this specification and will issue project specific standard literature "Life of the Concrete" warranties and adhesion guarantees prior to installation of any slab finishes when requested; no further field slab moisture nor pH testing shall be required.

2. A contracted independent and certified agency of the "PIA" manufacturer's choice must be present at the jobsite during placement of all "PIA" treated concrete.

    1. Do not proceed without this contracted, qualified representative being present.
    2. A minimum of one business day notification is required.

3. Field testing technician shall procure at least one 4x8 inch (102 mm) cylinder from a random project placement of "PIA" dosed concrete for subsequent hydraulic conductivity/coefficient of permeability testing.

4. All cylinders shall be independently lab tested in accordance with ASTM D 5084 and/or Army Corp of Engineers CRD C48-92.

5. Test results must conform to specified limits.

    1. Should any cylinder from any day of placement deliver results more than 6.0 E-08 cm/sec, the PIA manufacturer shall procure, at their expense, a core (or cores) from that day's placement. This core (cores) shall be sent to an independent laboratory for hydraulic conductivity testing (coefficient or permeability) per ASTM D 5084.
    2. Should any core deliver results more than 6.0 E-08 cm/sec per ASTM D 5084, the concrete porosity inhibiting admixture manufacturer shall provide, at their expense, a topical moisture mitigation system for the tested areas not meeting the stated limit provided dosing and field process protocol was followed.

6. Proceeding with any concrete placement dosed with the "PIA" and without the required representation will result in the contractor bearing the cost to core and ship appropriate material for testing per ASTM D 5084 and the possible subsequent remediation expenses.

3.4 REPAIRS

A. Make concrete repairs to slab in accordance with Division 03 Section "Cast-in-Place Concrete".

END OF SECTION 03 05 10