

MCI QUESTIONS & ANSWERS

Q. What is MCI?

A. MCI stands for Migrating Corrosion Inhibitor. MCI is a trademark of Cortec Corporation.

Q. Who is Cortec Corporation?

A. Cortec Corporation, St. Paul, MN, is a leading supplier of VCI (Vapor Corrosion Inhibitors) chemicals. Our 17 years of corrosion work resulted in many major corporations incorporating Cortec VCI's in corporate specifications. These include companies such as Arco, DuPont, Exxon, Mobil, Conoco, Ford, General Motors, VW, Mercedes, and many others. Engineering companies include Bechtel, Brown & Root, Black & Veatch, M. W. Kellogg and many others. Supply and technical support is available worldwide.

Q. What does MCI protect?

A. MCI inhibitors protect steel in concrete from corroding (rusting) in the presence of chlorides and other contaminants. Steel starts corroding in concrete when chloride levels reach 0.7 Kg/M^3 (1.2 lbs/Yd^3). Steel normally does not corrode in concrete when there is less salt than this. Other contaminants include polluted air (nitrogen oxides), carbonation (Carbon dioxide), or acid rain (sulfur dioxide). The carbonation process reduces the pH level in concrete and allows faster deterioration of steel or the steel reinforcing members.

Q. Does MCI protect the concrete matrix from corrosive attack?

A. We believe it has some such properties, but tests have not been completed to prove this.

Q. Are MCIs similar to VCI's (Vapor Corrosion Inhibitors)?

A. MCIs are chemically similar to VCI. The protection mechanism is identical.

Q. What is the chemistry of MCI or VCI protection?

A. These inhibitors have relatively high vapor pressures. They protect the steel at both the anode and cathode. This combination of properties gives unique protection at very low concentrations. A paper (#308, NACE CORROSION 83, "Use of Vapor Phase Inhibitors for Corrosion Protection of Metal Products") explains the detailed chemistry of this type of inhibitor. It is available on request from Cortec Corporation.

Q. Are there other inhibitors on the market?

A. Yes, Calcium nitrite, also called DCI, or DAREX, manufactured by W. R. Grace. It has been used commercially for 17 years. However, in recent testing, Calcium nitrite has been proven to damage the concrete.

Q. What is the difference between calcium nitrite and MCI?

A. Calcium nitrite is an inorganic Anodic inhibitor. MCI is an organic mixed (anodic/cathodic) inhibitor.

Q. Is this important?

A. Yes. ANODIC inhibitors are "dangerous" inhibitors. They are effective at low chloride concentrations, but when chloride concentrations reach a critical level, they may accelerate the corrosion process.

Q. What is the maximum chloride level DCI should be used at?

A. The maximum design criteria is 7.8 Kg/M³ (13 lbs/Yd³).

Q. What is so special about MCI?

A. MCI protects steel in concrete IN THE PRESENCE OF CHLORIDES.

Q. Does MCI have a "critical" chloride problem?

A. No. MCI will protect across a wide range of chloride levels. This is extremely important as prediction of chloride levels is almost impossible. Field measurements have shown vastly different levels only a few feet or meters apart.

Q. Is MCI a sealer or surface conditioner?

A. No. MCI penetrates deeply into concrete and stops or retards corrosion. (MCI used as an admixture also retards chloride ingress).

Q. What is the proof MCI penetrates deeply into concrete? Conventional sealers penetrate only a few mm (1/8-1/4").

A. Radioactive tagging of MCI proves penetration of up to 4 cm (1.6") in only 24 days. Copies of test results are available.

Q. How does MCI migrate into or penetrate concrete?

A. First, by diffusing in water normally present in concrete; secondly, by its high vapor pressure (air pockets will contain MCI vapors, protecting steel with no concrete contact); thirdly, MCI follows hairline and micro-cracks, allowing large doses to penetrate where protection is more critical.

Q. What other tests show the effectiveness of MCI?

A. Many, including:

- 1986--Wiss, Janney, Elstner--ASTM G109 Salt Ponding
- 1993--SHRP S 666, Corrosion Inhibitors
- 1993--SHRP S 658, Bridges, Field Validation
- 1986-1993--MN-DOT, Randolph Bridge over I35E, St. Paul

Q. How is MCI used?

A. There is a range of products for virtually every situation:

1. MCI-2000, added to concrete during mixing and installation
2. MCI-2001, a powdered form of MCI
3. MCI-2003, a gelled form of MCI
4. MCI-2005, a water based version of MCI-2000 with less odor
5. MCI-2010/2011, an emitter version of MCI
6. MCI-2020, a water based surface treatment for existing concrete structures.

Q. How exactly is MCI-2000 used?

A. MCI-2000 is added to concrete at the batch plant just like any other admixture--pumped through metering equipment during the batching process.

Q. How much MCI-2000 is added?

A. Most testing has been done at 0.7 liter/M³ (1 pint/Yd³). This dosage may be doubled if desired without affecting the mix.

Q. Does MCI-2000 affect any properties of the concrete mix?

A. Not normally. Tests run at independent testing laboratories show little or no effect on compressive strength, set time, freeze-thaw stability, air entrainment, or water requirements.

In a few isolated cases, air entrainment has been reported to change slightly. As we can not evaluate all combinations of admixtures, cements, aggregates, water, etc., a laboratory batch made prior to the job will show if minor changes are necessary.

Q. MCI-2000 has a strong odor. Does this show up in the finished mix?

A. After addition of MCI-2000, no odor can be detected in the mix.

Use of MCI-2005 eliminates this problem.

Q. How exactly can MCI-2000 be added?

A. By direct addition to the mix at the batch plant; by incorporation into the mix water (after calculating how much water is to be added, and making a mix so the desired 0.7 liter/M³ concentration is maintained); by adding to the truck at the job site; or if bagged mortar at the site is being mixed, by adding the appropriate amount during mixing.

Q. MCI-2000 has a flash point of 41C (105F). Is this a problem?

A. No. MCI-2000 is classed as a flammable liquid. Handling is the same as for mineral spirits used as a paint thinner. Normally MCI-2000 is added at the batch plant, pumped from sealed drums. Vapors normally would not be present. It is not nearly as flammable as most paint thinners or gasoline (flash point of about 20F). Introduction of MCI-2005 eliminates the flammability concern.